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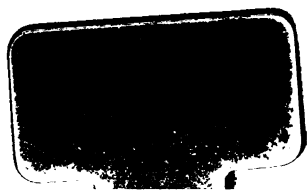
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BARTER'S
ARITHMETIC.



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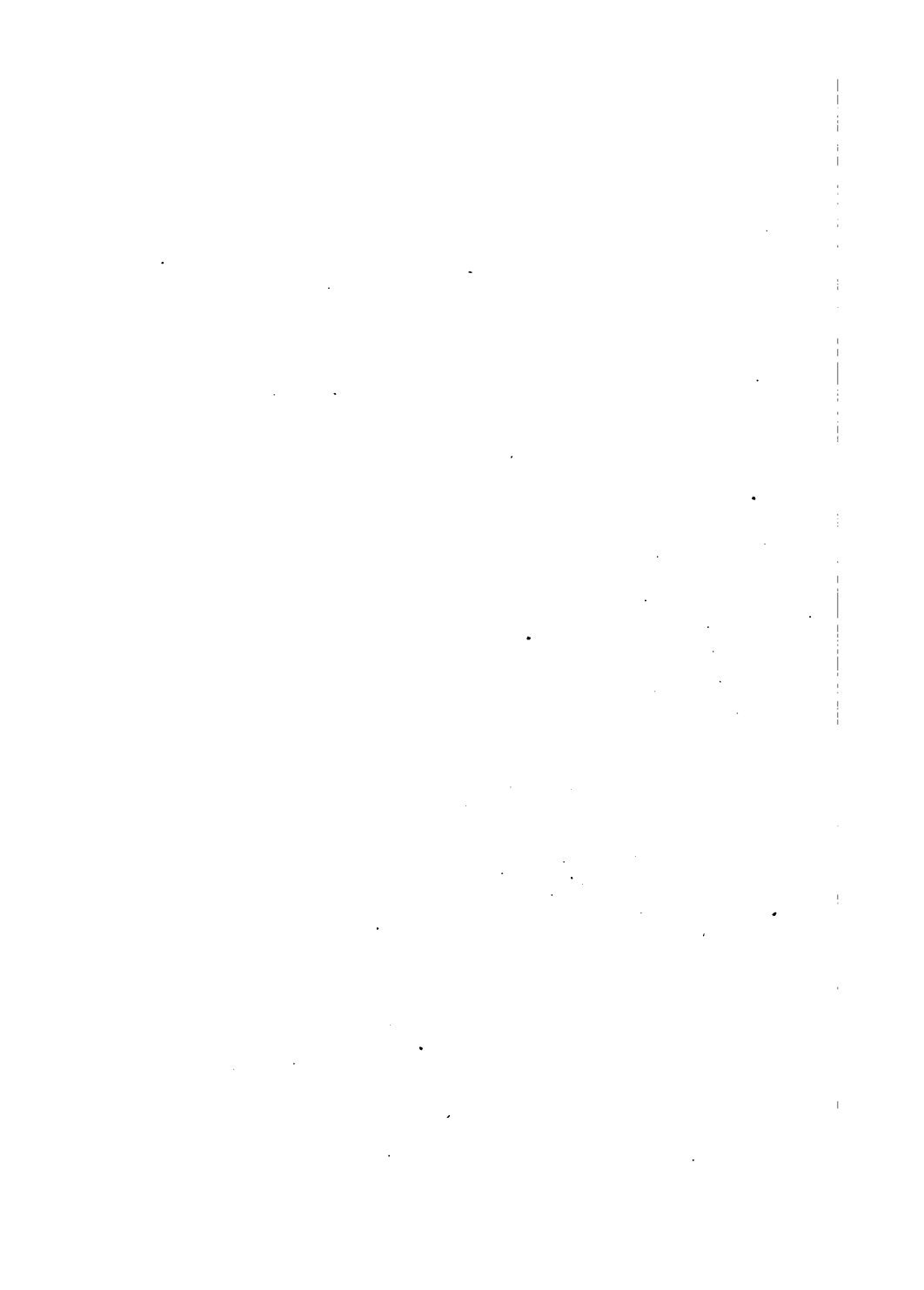
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ARITHMETIC

For Use in Schools and Colleges

ESPECIALLY HELPFUL TO PUPIL TEACHERS AND
STUDENTS PREPARING FOR EXAMINATION

BY THE REV. J. BARTER

SCIENCE AND ART COLLEGE, PLYMOUTH

LATE CHAIRMAN OF THE PLYMOUTH SCHOOL BOARD



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TABLES OF WEIGHTS AND MEASURES.

TROY WEIGHT.

4 grains	= 1 carat
24 grains	= 1 pennyweight (dwt.)
20 dwts.	.	.	.	.	= 1 ounce (oz.)
12 oz.	.	.	.	.	= 1 pound (lb.)

A VOIRDUPOIS WEIGHT.

27·34375 troy grains	.	.	.	.	= 1 dram.
16 drams	.	.	.	.	= 1 ounce.
16 ounces	.	.	.	.	= 1 pound.
14 pounds	.	.	.	.	= 1 stone.
28 pounds }	.	.	.	.	= 1 quarter.
2 stones }	.	.	.	.
4 quarters make }	.	.	.	.	= 1 hundredweight.
8 stones }	.	.	.	.
20 cwts.	.	.	.	.	= 1 ton.

The 1 lb. avoirdupois = 7000 grains troy.

APOTHECARIES' WEIGHT.

20 grains	.	.	.	.	= 1 scruple (℥).
3 scruples	.	.	.	.	= 1 dram (ʒ).
8 drams	.	.	.	.	= 1 ounce (℥).
12 ounces	.	.	.	.	= 1 pound (lb.).

TABLES OF WEIGHTS

CLOTH MEASURE.

2 $\frac{1}{4}$ inches	.	.	.	.	= 1 nail.
4 nails	.	.	.	.	= 1 quarter.
3 quarters	.	.	.	.	= 1 Flemish ell.
4 "	.	.	.	.	= 1 yard.
5 "	.	.	.	.	= 1 English ell.
6 "	.	.	.	.	= 1 French ell.

LAND, SQUARE, OR SUPERFICIAL MEASURE.

144 square inches	.	.	.	.	= 1 square foot.
9 " feet	.	.	.	.	= 1 square yard.
30 $\frac{1}{2}$ " yards	.	.	.	.	= 1 square pole.
40 " poles	.	.	.	.	= 1 rood.
4 roods or 4840 yards	.	.	.	.	= 1 acre.
640 acres	.	.	.	.	= 1 square mile.

MEASURES OF CAPACITY.

4 gills	.	.	.	.	= 1 pint.
2 pints	.	.	.	.	= 1 quart.
4 quarts	.	.	.	.	= 1 gallon.
2 gallons	.	.	.	.	= 1 peck.
4 pecks	.	.	.	.	= 1 bushel.
8 bushels	.	.	.	.	= 1 quarter.
5 quarters	.	.	.	.	= 1 load.

CUBIC OR SOLID MEASURE.

1728 cubic inches	.	.	.	.	= 1 cubic foot.
27 cubic feet	.	.	.	.	= 1 cubic yard.

LONG MEASURE.

12 inches	.	.	.	.	= 1 foot.
3 feet	.	.	.	.	= 1 yard.
6 feet	.	.	.	.	= 1 fathom
5 $\frac{1}{2}$ yards	.	.	.	.	= 1 rod, pole, or perch.
4 poles or 22 yards	.	.	.	.	= 1 chain.
40 poles or 220 yards	.	.	.	.	= 1 furlong.

AND MEASURES.

3

8 furlongs or 1760 yards	.	.	.	.	= 1 mile.
3 miles	.	.	.	.	= 1 league.
69 $\frac{1}{2}$ miles	.	.	.	.	= 1 degree.

LIQUID MEASURE.

2 pints	.	.	.	.	= 1 quart.
4 quarts	.	.	.	.	= 1 gallon.
9 gallons	.	.	.	.	= 1 firkin.
2 firkins	.	.	.	.	= 1 kilderkin.
42 gallons	.	.	.	.	= 1 tierce.
36 gallons	.	.	.	.	= 1 barrel of beer.
54 gallons	.	.	.	.	= 1 hogshead of beer.
63 gallons	.	.	.	.	= 1 hogshead of wine.
2 hogsheads	.	.	.	.	= 1 pipe.
2 pipes	.	.	.	.	= 1 tun.

ANGULAR MEASURE.

60 seconds (")	.	.	.	.	= 1 minute (').
60 minutes	.	.	.	.	= 1 degree (°).
360 degrees	.	.	.	.	= 1 circumference.

TIME.

60 seconds	.	.	.	.	= 1 minute.
60 minutes	.	.	.	.	= 1 hour.
24 hours	.	.	.	.	= 1 day.
7 days	.	.	.	.	= 1 week.
4 weeks	.	.	.	.	= 1 month (lunar).
365 days 6 hours	.	.	.	.	= 1 year.

PAPER MEASURE.

24 sheets	.	.	.	.	= 1 quire.
20 quires	.	.	.	.	= 1 ream.

NAUTICAL MEASURE.

6080 feet	.	.	.	.	= 1 knot.
60 knots	.	.	.	.	= 1 degree.

TABLES OF WEIGHTS

MILES.

1 English mile	.	.	=	5280	feet.
1 nautical "	.	.	=	6080	"
1 German mile	.	.	=	24302·4	"
1 French (league)	.	.	=	14580·8	"
1 Prussian mile	.	.	=	24712·5	"

COMPARISON OF ENGLISH AND FRENCH WEIGHTS AND MEASURES.

15·434 grains	.	.	.	=	1 gramme.
2·2048 lbs. (avoir.)	.	.	.	=	1 kilogramme.
1 cwt. 3 qrs. 24½ lbs.	.	.	.	=	1 quintal
1 lb. (avoir.)	.	.	.	=	·4535 kilog.
1 ton English × ·984	.	.	.	=	1 ton French.
61·028 cub. ins. or 1·761 pints	.	.	.	}	= 1 litre (a cub. decimetre).
1 gallon	.	.	.	.	= 4·543 litres.
1 cubic inch	.	.	.	.	= ·0163 litre.
39·3708 English ins.	.	.	.	.	= 1 metre.
6·394 "	ft.	.	.	.	= 1 toise.
·039371 "	ins.	.	.	.	= 1 millimetre.
·39371 "	"	.	.	.	= 1 centimetre.
3·39371 "	"	.	.	.	= 1 decimetre.

MEASURES OF CAPACITY. LIQUID AND DRY GOODS.

8·665 cu. ins.	.	.	.	=	$\frac{5}{16}$ lbs. of water, 1 gill.
4 gills	.	.	.	=	34·659 cu. ins., 1 pint.
1 gallon	.	.	.	=	10 lbs. avoird. of water.
1 pint	.	.	.	=	1½ " "
1 bushel	.	.	.	=	80 " "
1 central	.	.	.	=	100 " "

MISCELLANEOUS BRITISH MEASURES.

6 lineal feet	.	.	.	=	1 fathom.
100 square feet	.	.	.	=	1 sq. of flooring.

272 sq. ft. $1\frac{1}{2}$ bricks	}	.	.	= 1 rod of brickwork.
thick, 14 ins.				
600 sq. ft. of 1 in. boards	.	.	.	= 1 load.
40 cu. ft. of rough timber	.	.	.	= 1 ton or load.
50 cu. ft. of hewn timber	.	.	.	= 1 ton or load.
40 cu. ft.	.	.	.	= 1 ton of shipping.
500 bricks	.	.	.	= 1 load.
32 bushels of lime	.	.	.	= 1 "
36 bushels of sand	.	.	.	= 1 "
22 cwt. at Stockton	.	.	.	= 1 fodder of lead.
21 " Newcastle	.	.	.	= 1 " "
19 $\frac{1}{2}$ " London	.	.	.	= 1 " "
36 bush. (28 cwt.), London	.	.	.	= 1 chaldron of coal.
53 cwt. at Newcastle	.	.	.	= 1 " "
88 lbs.	.	.	.	= 1 bus. of coals.
56 lbs.	.	.	.	= 1 bus. of flour or salt.
1 boll wheat (Glasgow)	.	.	.	= 240 lbs.
1 " barley "	.	.	.	= 320 "
1 " oats "	.	.	.	= 264 "
1 barrel of wheat	.	.	.	= 280 "
1 " barley (Irish)	.	.	.	= 224 "
1 " oats	.	.	.	= 196 "
2 bags	.	.	.	= 1 sack.
4 " "	.	.	.	= 1 quarter.
1 sack of flour	.	.	.	= 240 lbs.

DECIMALS TO FACILITATE CALCULATIONS.

Lineal feet multiplied by	·000189	= miles.
" yds. " "	·000568	= "
Square inches " "	·007	= square feet.
" yds. " "	·0002067	= acres.
Cubic feet " "	6·232($6\frac{1}{4}$)	= gallons.
Cubic inches " "	·003607	= "
" " "	·263	= lbs. cast iron.
" " "	·281	= " wrought iron.
" " "	·283	= " steel.
" " "	·3225	= " copper.
" " "	·3037	= " brass.

THE METRIC SYSTEM.

To multiply the unit of any measure, Greek prefixes are used.

To divide the unit of any measure, Latin prefixes are used.

MULTIPLIERS (*Greek*).

Deka	.	.	.	=	10
Hecto	.	.	.	=	100
Kilo	.	.	.	=	1000
Myria	.	.	.	=	10000

DIVISORS (*Latin*).

Deci	.	.	.	=	$\frac{1}{10}$	(one tenth).
Centi	.	.	.	=	$\frac{1}{100}$	(one hundredth).
Milli	.	.	.	=	$\frac{1}{1000}$	(one thousandth).

MEASURES OF LENGTH.

The Metre, the unit of length, is the ten-millionth part of a line drawn from the Pole to the Equator = 39·3708 English inches = 3 feet 3 $\frac{3}{8}$ inches.

1 millimetre = $\frac{1}{1000}$ of a metre.

1 centimetre = $\frac{1}{100}$ of a metre.

1 decimetre = $\frac{1}{10}$ of a metre.

1 metre	=	Eng. ins. 39·3708.
---------	---	---	---	---	---	-----------------------

1 dekametre = 10 metres . . = 393·708.

1 hectometre = 10 dekametres . = 3937·08.

1 kilometre = 10 hectometres . = 39370·8 = nearly 1094 yards.

1 myriametre = 10 kilometres . = 393708 = 6 miles 37 yards.

1 yard = ·914 metre. 1 mile = 1·609 kilometre. 8 kilometres = 5 English miles nearly.

MEASURES OF SURFACE.

The Are, the unit of surface measure, is a square, the side of which is 10 metres long : therefore the Are = 100 square metres = 119·6033 square yards.

1 centiare = $\frac{1}{100}$ of an are.

1 deciare = $\frac{1}{10}$ of an are.

		Eng. sq. ft.
1 are	= 119·6033 sq. yds.	= 1076·43

1 dekare = 10 ares . . = 10764·3

1 hectare = 10 dekares . = 107643 = $2\frac{1}{2}$ English acres nearly.

1 acre = rather more than 40 ares.

MEASURES OF SOLIDITY.

The Stere, the unit of cubic measure, = 1 cubic metre = 35·3166 English cubic feet.

1 centistere . . = $\frac{1}{100}$ of a stere.

1 decistere . . = $\frac{1}{10}$ of a stere.

1 dekastere . . = 10 steres, or 353·166 English cubic feet.

MEASURES OF CAPACITY.

The Litre, the unit of the measures of capacity, dry and liquid, = 1·761 pint, or rather more than $1\frac{1}{4}$ pints.

1 millilitre = $\frac{1}{1000}$ of a litre.

1 centilitre = $\frac{1}{100}$ of a litre.

1 decilitre . = $\frac{1}{10}$ of a litre.

		Eng. im. gals.	qrs.	bsh.	pks.	pts.
1 litre	= . . .	·2201				
1 dekalitre	= 10 litres .	= 2·201	=		1	1·6077.
1 hectolitre	= 10 dekalitres	= 22·01	=		2	3 0·077.
1 kilolitre .	= 10 hectolitres	= 220·1	=	3	3 2	0·77.
1 gallon = 4·543 litres. 11 gallons = 50 litres nearly.						

MEASURES OF WEIGHT.

The Gram, the unit of weight, is the weight of a cubic centimetre of distilled water at 4° centigrade = '56438 drams.

1 milligram = $\frac{1}{1000}$ of a gram.

1 centigram = $\frac{1}{100}$ of a gram.

1 decigram = $\frac{1}{10}$ of a gram.

		Eng. gra.	sts. lbs. ozs.	drs.
1 gram	.	15·4323	=	'56438
1 dekagram	= 10 grams	154·323	=	5·6438
1 hectogram	= 10 dekagrams	1543·23	=	3 8·4383
1 kilogram	= 10 hectograms	15432·3*	=	2 3 4·3830
1 myriagram	= 10 kilograms	154323	=	1 8 0 11·8304
1 grain	= '0648 gram.			
1 lb. avoird.	= '4536 kilogram.			
1 cwt.	= 50·8 kilogram.			
1 quintal	= 100 kilograms = 1 cwt. 7 sts. 10 lbs. 7 oz. 6·304 drs. = 2 cwts. nearly.			
1 millier	= 1000 kilograms = 19 cwts. 5 sts. 6 lbs. 9 oz. 15·04 drs. = 20 cwts., or 1 ton nearly.			

MONEY.

The Franc, the unit of the French monetary system, is a silver coin = about 9½d English.

1 decime = $\frac{1}{10}$ of a franc.

1 centime = $\frac{1}{100}$ of a decime = $\frac{1}{1000}$ of a franc.

The franc was originally divided into 20 sous, and in ordinary language the decime is spoken of as two sous.

* Nearly 2½ lbs.

BARTER'S ARITHMETIC.

FIRST PART.

QUESTIONS similar to the following have been used by the Author for many years in a large middle-class school with great success.

He has learnt from long experience that the "Rules and Examples" given in the usual books on arithmetic, are seldom or never studied by one learner out of a hundred. The first few sums in every "Case" have to be explained, and generally worked out, by the teacher before any progress is made; and usually the questions which follow vary only in the substitution of one figure for another, so that the labour involved is little more than mechanical. The present work is not intended to supersede, but to supplement the ordinary arithmetical guides. Knowledge must be acquired before its extent can be tested; therefore, the first duty of the pupil is to acquire, say the first four rules, simple and compound, with Reduction: then test the thoroughness of his knowledge by working out the questions contained in the Exercises I. to C.

The questions should be taken in their order, *omitting no part*, however simple it may appear; they have been graduated with great care, and if the order be strictly followed they cannot fail to

stimulate thought, promote skill, and secure accuracy. Teachers who may be induced to use this book will do well to regulate their class instruction by it, and dictate the questions in one Exercise daily for *home-work*, to be brought the following morning, carefully and neatly worked *on paper*.

As the Author has been in the habit of collecting good questions wherever he has come upon them, some such may be detected among the following ; if so, and the authors should object, the error shall be acknowledged with regret, and not repeated in any future edition.

Observe :—The Author strongly advises that Multiplication and Division be taught together, especially at first, as if they were two operations of one rule, being careful to distinguish between the answer and proof. Many difficulties which occur in the usual mode are thereby obviated, and the interest of the learner is excited as he sees figure after figure come out as proof of his correct working.

Example 1.—Multiply 7649126 by 8.

$$\begin{array}{r}
 7649126 \\
 8 \\
 \hline
 8)61193008 \quad \textit{Answer.} \\
 \hline
 7649126 \quad \textit{Proof.} \\
 \hline
 \hline
 \end{array}$$

Example 2.—Multiply 5496943 by 346.

346	1
692	2
1038	3
1384	4
1730	5
2076	6
2422	7
2768	8
3114	9

$$\begin{array}{r}
 5496943 \\
 \times 346 \\
 \hline
 32981658 \\
 21987772 \\
 16490829 \\
 \hline
 346)1901942278 \text{ Ans. (5496943 Proof.} \\
 \underline{1730} \\
 1719 \\
 \underline{1384} \\
 3354 \\
 \underline{3114} \\
 2402 \\
 \underline{2076} \\
 3262 \\
 \underline{3114} \\
 1487 \\
 \underline{1384} \\
 1038 \\
 \underline{1038} \\
 \hline
 \hline
 \end{array}$$

Example 3.—Multiply £64 15s. 7d. by 6.

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 64 \quad 15 \quad 7 \\
 \times 6 \\
 \hline
 6)388 \quad 13 \quad 6 \text{ Ans.} \\
 \underline{64 \quad 15 \quad 7} \text{ Proof.} \\
 \hline
 \hline
 \end{array}$$

Example 4.—Multiply 3 ton 12 cwt. 1 qr. 14 lbs. 9 oz. 6 drs. by 305.

t. c. q. lbs. oz. drs.									
3	12	1	14	9	6				
					10				
36	3	3	5	13	12				
					10				
361	18	0	2	9	8				
					3				
1085	14	0	7	12	8				
18	1	3	16	14	14				
305	1103	15	3	24	11	6	Ans.	(3	t. c. qr. lbs. oz. drs.
915									
188									
20									
3775									
3660									
115									
4									
463									
305									
158									
28									
4448									
305									
1398									
1220									
178									
16									
2859									
2745									
114									
16									
1830									
1830									

305	1
610	2
915	3
1220	4
1525	5
1830	6
2135	7
2440	8
2745	9

t. c. qr. lbs. oz. dr.
Ans. 1103 15 3 24 11 6

EXERCISE I.

1. Write in words 189, 640, 209.
2. Write in figures four hundred and twenty-one ; five hundred and four ; two hundred and sixty.
3. Add together 9864, 4769, 7907, 5869, 578, and 24.
4. Find the result of $4059 + 760786 + 1439 + 986407 + 408067$.
5. Find the sum of 980, 43609, 9908, 78078, 11011, 999874.
6. Add together 777, 439, 709053, 54806, 655073, 864, 1999.

EXERCISE II.

1. How much would it cost to supply 27 inmates of an orphanage with a pair of shoes at 8s. 9d. each ?
2. Find the cost of half gross of hurdles, four bars each, at $9\frac{1}{2}$ d. per bar.
3. Calculate the expense of $1\frac{1}{2}$ doz. loaves of bread at $4\frac{1}{2}$ d. each, $7\frac{1}{2}$ doz. 1d. buns, and 100 farthing cakes.
4. Gave £30 for a watch, chain, and brooch ; the watch cost eight times as much as the chain, and the brooch one-tenth of the whole ; what was the price of each ?
5. What will 5d. per day amount to from Midsummer-day to Christmas-day ?
6. Compare the number of seconds in the 3 shortest months (not leap-year), with the 3 longest months in the year.

EXERCISE III.

1. Write in words 2468, 3470, 8506.
2. Write in figures six thousand eight hundred and four ; two thousand and sixty ; four thousand and nine.
3. Find the sum of 576987, 66989, 755777, 89788, 778876, 79998.
4. Add together 789786, 17932, 904766, 788777, 867999, 754444, 989896.
5. Find the difference between 7372 and 3455.
6. Take 306 marbles out of a bag containing 2704, and tell how many remain.

EXERCISE IV.

1. How many loaves, each weighing $7\frac{1}{2}$ lbs., can be made out of a sack of flour of 280 lbs ?
2. Reduce 321 half-crowns to guineas, and multiply the result by 47.
3. Give to 16 men, 13 women, and 19 children, each one guinea, 3 half-crowns, and a fourpenny-piece ; required the amount.
4. How far can I travel for £1 9s. 4d., at $\frac{3}{4}$ d per mile ?
5. What will it cost per annum to shoe a stable of 46 horses, supposing they require new shoes once in two months, and each cost 2s. 6d. ?
6. Divide 105 yrs. 34 weeks 5 dys. 17 hrs. 40 m. into 72 equal periods, and subtract the quotient (omitting remainder), from a century.

EXERCISE V.

1. Write in words 5600, 8407, 5006.
2. Write in figures seven thousand two hundred and four ; three thousand and twenty-five ; sixty thousand and one.
3. Add together 789725, 333333, 979797, 868631, 704093, 217479 579069, 89787, 6679.
4. January has 31 days, February 28, March 31, April 30, May 31, June 30, July 31, August 31, September 30, October 31, November 30, December 31 ; how many in all ?
5. Subtract 868704368 from 7648200059.
6. One estate contains 78069 acres, another 16736 acres ; how much is one larger than the other ?

EXERCISE VI.

1. A man walked 42 miles in 12 hours ; this was at the rate of how many miles an hour ?
2. If eggs are 3 for 2d., how many can be purchased for half-a-crown ?

3. How long will a train take to travel 150 miles, at the rate of 50 miles an hour ?

4. A jeweller sent 6 packages of old silver-plate, one weighing 1000 ozs., two 3 lbs. 10 oz. 16 dwts. each, and each of the others 250 oz., to be cast into 3 bars of equal weight ; required what each would weigh.

5. A lad earns £5 12s. 6d. for a piece of work which has paid him at the rate of 2s. 6d. per day ; how many days was he employed in it ?

6. 500 persons visited an exhibition, and paid 2s. 6d. each, 1020 at 1s. 6d. each, and 2500 at 1s. each ; find the total receipts.

EXERCISE VII.

1. Write in words 24864, 40275, 80036.

2. Write in figures thirty-two thousand three hundred and twenty-five ; fifty thousand one hundred and four ; seventy thousand and ten.

3. Adam lived 930 years, Seth 912, Enos 905, Cainan 910, Mahaleel 895, Jarad 962, Enoch 365, Methuselah 969, Lamech 777, Noah 950, Shem 600, Arphaxad 438, Salah 433, Heber 464, Peleg 239, Reu 239, Sereg 230, Nahor 148, Terah 205, Abraham 175, Isaac 180, Jacob 147, Joseph 110, Moses 120, Joshua 110 ; find the sum of their ages.

4. A farmer having 204 sheep in one field, 168 in another, and 205 in a third, sold 150 to a dealer ; how many were left ?

5. A fruiterer bought a box containing 624 oranges and sold 25, 60, 38, and 165 ; how many had he left ?

6. In what year was a man born who died in 1874 aged 85 ?

EXERCISE VIII.

1. If £1 12s. 6d. be put by weekly, what will it amount to in the course of a year ?

2. A servant whose wages was £16 per annum, would receive how much for seven months ?

3. A wholesale druggist set apart 3000 oz. of drugs, with which to fit up some country shops, at an average of 10 lbs. 6 drs. 2 sc. 18 grs. ; how many could he supply ?

4. In a certain factory the daily wages are £63 ; the men received 4s. 9d., the women 3s., and the children 1s. 3d. each, there is an equal number of each ; find how many hands are employed.

5. A traveller was out for a week at an allowance of one guinea per day ; he paid portage 5s. 6d., cab hire 7s. 6d., railway fare £1 19s. 4d., and hotel bill £2 10s. ; how much did he save ?

6. Three gross of pens at $\frac{1}{4}$ d. each.

EXERCISE IX.

1. Find the sum of 6778275, 690343, 8771527, 9478698, 798667497, 999999999, 204.

2. Add together 79361377, 975086, 6745366, 9370979, 77871897, 88888888, 305.

3. From 683216432 take 89532178 ; and from 4723698007 take 493298126.

4. Multiply 897063 by 504017.

5. Multiply 60538067 by 83.

6. Multiply 247003 by 6020.

EXERCISE X.

1. What is the monthly income of a gentleman whose salary is £325 per annum ?

2. How many seconds in the month of February, 1876 ?

3. What sum will be required to pay the wages of 347 men for one week at 4s. 6d. each per day ?

4. A book containing 566 pages had 35 leaves torn out ; how many pages were left ?

5. How many fourpenny-pieces in £17 18s. 4d. ?

6. A cistern holding 160 gallons was supplied with a tap which let in 9 gallons a minute ; the cistern leaked one gallon a minute ; how long would it take to fill after the tap was turned on ?

EXERCISE XI.

1. Multiply 77869 by 560, and 75060 by 914.
2. Multiply 937860 by 908, and 207019 by 390.
3. If 8679 passengers travel daily by a certain railway, what will be the total number for 23 days?
4. If 76979 pens are sold per month, how many are sold in 48 months?
5. Supposing an army to consume 3736 loaves per day, how many would be required for 127 days?
6. Divide 86497 by 36, by long and short division.

EXERCISE XII.

1. What will 1000 plums cost at 20 a penny?
2. A horse and cart cost £56, the horse was worth seven times the value of the cart; what was the price of each?
3. A ship laden with 175 tons of coal lost 23 tons $5\frac{1}{2}$ cwt. overboard, delivered 82 tons 15 cwt. to the store, and sold the remainder to 89 families; what weight did each receive?
4. What sum multiplied by 605 will give a product of 48400?
5. What would it cost to feed an army of 1000 soldiers for a year, supposing it cost 10s. 6d. for six men per day?
6. A gentleman expended £5800 on the erection of a mansion for himself at a cost of £4950, and seven cottages for his labourers; find the cost of each cottage.

EXERCISE XIII.

1. Multiply eighty thousand seven hundred and eight by sixteen thousand and four, and subtract forty-nine from the result.
2. From the product of ten thousand and forty and eight thousand and twelve take nine hundred and ninety-nine.
3. Divide the sum of 8649 and 46794 by 11.
4. Multiply the difference of 64901 and 467914 by 89.
5. To the product of 1234 and 25 add 68, and divide the sum by 9.

6. From the quotient of thirteen thousand and thirty-nine by twelve take 124.

EXERCISE XIV.

1. A job lot of glass, consisting of a dozen wine glasses, 6 rummers, 4 salts, and two butter dishes, for 4s. 6d.; how much was this for each piece?

2. Multiply the sum and difference of 8 and 9, and subtract the produce from the sum of 14 and 16.

3. Find the cost of a dozen table-knives at 1s. $2\frac{1}{2}$ d. each, $3\frac{1}{2}$ dozen of dessert-knives at $9\frac{1}{4}$ d. each, and a pair of carvers at 5s. 6d. each.

4. Change the contents of a purse containing 11 sovereigns, 4 half-sovereigns, 7 half-crowns, and 40 threepenny-pieces, into sixpences.

5. How many loaves at $5\frac{1}{2}$ d. each can be purchased for £1 5s.?

6. If in walking a mile 2112 steps be taken, what is the distance of each step?

EXERCISE XV.

1. An umbrella with eight ribs cost 7s. 2d.; supposing the stick to be worth 1s. 2d., what would be the value of each rib?

2. A charwoman received 13s. 3d. for cleaning down a house; she charged 9d. for the passage, and 1s. 3d. for each room; how many were there?

3. What will 135 marbles cost, at 15 for twopence?

4. How many penny cakes can be purchased for two guineas and three half-crowns?

5. How far can I travel for 10s., at $\frac{3}{4}$ d. per mile?

6. What will the education of a child cost for 10 years, at £1 17s. 6d. per quarter?

EXERCISE XVI.

1. Find the difference in feet between the equatorial diameter of the earth, which is $7925\frac{1}{2}$ miles, and the polar diameter, which is 7899 miles?

2. The earth's greatest distance from the sun is ninety-two millions, nine hundred and sixty-five thousand miles, and its least distance eighty-nine millions, eight hundred and ninety-five thousand miles ; find its mean distance.

3. Twenty-three persons order a dinner, for which they pay £17 16s. 6d. ; what is each person's share.

4. A gentleman's income is £547½, how much can he afford to spend per day ?

5. How long would it take to count a million, at the rate of 1000 an hour, 9 hours a day, and 6 days a week ?

6. What is the difference between 63½ guineas and £74 10s. 6d. added to 23 half-crowns.

EXERCISE XVII.

1. Find the sum, difference, product, and quotient of 9423 and 1047.

2. The product of two numbers, one of which is 3736, is 474472 ; what is the other ?

3. What is the continued product of the sum, difference, product, and quotient of 32 and 96.

4. The quotient of two numbers, the less of which is 49, is 347, and the remainder 27 ; what is the other ?

5. How many days are there in the last five months of the year ?

6. How many days from January 20th, 1857, to August 16th, 1863 ?

EXERCISE XVIII.

1. Suppose a gentleman spends £1 15s. 6d. a-day, and has only £500 a-year, how much will his debts exceed his income ?

2. How much does the fourth part of £861 10s. exceed the fifth part of £590 15s. 5d. ?

3. If a yard of cloth cost 3s. 6d., how many yards can be purchased for £4 9s. 3d. ?

4. A man earns 33s. 6d. a-week, spends 27s., and saves the rest ; find his yearly income, expenditure, and savings.

5. A contractor buys three horses at £26 10s. each, and sells two of them, one at £25 10s. the other at 33 guineas ; how much has the third horse cost him ?

6. A man and his son earn together £6 15s. ; the boy did half as much work as his father : how much was each one's share ?

EXERCISE XIX.

1. What amount would 577 passengers pay at £25 each ?

2. A regiment was supplied with 428 horses at £32 each ; what was the total cost ?

3. How many pages can be filled with 30294 words, every page having 51 lines of 9 words each ?

4. How many pence should a person pay for 84 lbs. of beef, at $8\frac{1}{2}$ d. per lb ?

5. How many lbs. of lamb at $10\frac{1}{2}$ d. per lb. can be bought for $136\frac{1}{2}$ d. ?

6. Divide 28s. between two boys, giving one six shillings more than the other.

EXERCISE XX.

1. A lady paid out of her purse £1 3s. 9d. ; this was half the contents and 1s. 3d. more. How much did the purse contain before and after the payment ?

2. A broker buys three shares in a company at £326 each, receives £40 dividend, and sells out at £324 15s. each ; how much does he gain by the transaction ?

3. How much would it cost to furnish a house of eight rooms, four at £20 and four at £15 9s. each ?

4. What is the difference between the cost of 59 lbs. of tea, at 4s. 3d. per lb., and 104 lbs. of sugar at $7\frac{1}{4}$ d. per lb. ?

5. How much will it cost to fit out a family consisting of father and mother, besides 5 boys and 4 girls, with a pair of boots each, those

for the father and boys being 15s. 9d., those for mother and girls 13s. 6d., each ?

6. Multiply the number of pence in a pound by the number of pence in a crown, and divide the product by the number in a gross.

EXERCISE XXI.

1. A gentleman's income is 300 guineas a year; he saves £10 a month; what does he spend per week ?

2. What change would a boy receive out of a sovereign after buying 96 apples at six a penny, 40 penny oranges, and a gallon of nuts at 4d. per quart ?

3. A workman received £7 4s. as wages; had he worked another fortnight he would have received £9; for what time was he paid, and how much did he earn a day ?

4. Bring 84 miles to inches.

5. Change 6285 half-crowns to threepenny pieces.

6. In 6 years, 32 weeks, 4 days, how many hours ?

EXERCISE XXII.

1. A gentleman leaves a fortune of £12000 to his two sons and three daughters, the eldest son is to have one-fourth and the rest to be equally divided; find the share of each.

2. In an estate of 460 acres are 39 fields; what is the average size of each ?

3. Subtract the sum of 1000 shillings, pence, and farthings, from 1000 half-crowns, and give the answer in £ s. d.

4. If a quire of paper cost $6\frac{1}{2}$ d., what would 74 reams cost at the same price ?

5. If 10 gross of buttons cost £1 10s., what is this per button ?

6. A party of 18 persons go on an excursion, £1 17s. 6d. is paid in railway fare, £5 0s. 6d. for refreshments, and 1s. 6d. for gratuities; how much was each person's share of the expenses ?

EXERCISE XXIII.

1. A gentleman paid 10s. for a railway ticket at $2\frac{1}{2}$ d. per mile ; how far was he going ?
2. The rent and taxes of a house amount to 15 guineas per quarter, the rent is four times as much as the taxes ; what is the yearly rental ?
3. If I spend one half of my money in tea, one half of the remainder in sugar, and have $3\frac{1}{2}$ d. left, how much had I in the first place ?
4. Multiply 6 tons 14 cwts. 2 qrs. 1 lb. by 256.
5. How many carriages with six seats each are required to convey 87 passengers ? how many would be left for the last carriage ?
6. Divide 3 m. 2 f. 30 p. by 39.

EXERCISE XXIV.

1. At a certain railway station 60 men are employed ; one half are porters at 25s., one-sixth clerks at 35s., the others at 27s. 6d. per week ; find the amount of wages for one week.
2. Ten persons invite 15 others to dine with them ; if the dinner cost 10s. 6d. each, how much will each of the ten have to pay ?
3. How many books of 240 pages can be made out of 10 reams of paper ?
4. In a public school are 120 pupils in average weekly attendance ; one-third pay 3d., one-third pay 2d., and the rest 1d. per week ; they have eight weeks holiday in the year ; what will be the income for the year ?
5. If 16 men take a fortnight to do a certain piece of work, how many men would do it in half the time ?
6. In a street of 66 houses, with an average number of 7 residents in each, are three public-houses ; how many persons are there to one public house ?

EXERCISE XXV.

1. A builder engages to erect a lot of cottages at £30 a room. The first, last, and two centre cottages are to have five rooms each, and four others four each ; required the cost of the eight cottages.

2. Suppose a man spend $3\frac{1}{2}$ d in beer, and $1\frac{1}{2}$ d. for tobacco per day, what will it amount to in a year ?
3. A man spends 3s. per day, and puts by £2 15s. the first day of every month ; required his income.
4. In 46 guineas, pounds and shillings, how many half-crowns ?
5. In 24689 minutes how many weeks, days, and hours ?
6. Divide £876 14s. 9½d. by 365.

EXERCISE XXVI.

1. In a village are 40 public lights, which are charged at 13s. 9d. each per month ; what is the whole cost per year ?
2. An article worth £16 was raffled for at 1s. each subscriber, the winner to pay £1 extra ; 60 persons took three chances each, 40 two chances each, and 30 one each ; a person of the first lot was successful. Find how much the article cost him, and how much the owner had to sacrifice ?
3. Change 1000 florins into guineas.
4. If I have a salary of £250 per annum, and have to pay 7d. out of every pound to the tax-collector, how much will he demand ?
5. After subtracting £264 19s. 8d. there were left £100 and 100 half-crowns ; what was the original amount ?
6. A news-boy sold 126 penny papers, for which he had given 9d. per dozen ; what was his profit ?

EXERCISE XXVII.

1. How many miles can a person travel for 18s. 8½d. at 1d. per mile.
2. How much would it cost to paint six venetian blinds, two having 50, two 45, and two 40 laths, at 1½d. each lath ?
3. If a table and six chairs cost £3 15s., what is the value of each chair, the table being worth two guineas ?
4. A man and his boy had a piece of work in hand which they could do in a week ; at the end of the fourth day the boy was taken

ill ; how much extra time would his father require in order to finish the work by himself (the man doing twice as much work as the boy) ?

5. The public lamps in a town numbered 1246 ; how much did they cost a year for lighting at £3 7s. 6d. each ?

6. Divide 26m. 6f. 26p. 2 yds. 2 ft. 8 in. by $49\frac{1}{2}$.

EXERCISE XXVIII.

1. Three chimney ornaments cost $1\frac{1}{2}$ guineas ; the centre one was equal in value to the other two ; what was the price of each ?

2. A window is 30 feet from the ground ; a ladder of how many bars will it take to reach it, supposing each bar to be 10 inches apart, and 3 bars allowed for the oblique position in which the ladder is placed ?

3. If 3543 bricks are used in building three chimneys, how many will be required for 13 ?

4. Bala Lake is four miles long and twelve hundred yards broad ; bring both to feet, and multiply them together.

5. A mother 28 years of age is four times as old as her child ; find the difference in hours between the ages of the two.

6. Two persons start together to walk to a place 20 miles distant ; one walks 4 miles, the other 3 miles, an hour. How long will one be at his destination before the other ?

EXERCISE XXIX.

1. If a boy earn 2d. an hour and work nine hours a day, how much will he earn in six weeks ?

2. A woman was sent to a market 10 miles off, where she sold 25 lbs. of butter at 1s. 3d. per lb., six fowls at 7s. a couple, 60 eggs at $1\frac{1}{4}$ d. each ; how much money ought she to bring home after paying 1d. per mile railway fare, 6d. for portorage, 8d. market toll, and 1s. 6d. for refreshment ?

3. If oranges are sold 7 for sixpence, how many can be purchased for 15s. 6d ?

4. Bring £81 14s. 2½d. to farthings, and divide them among 144 persons.
5. In a purse are pounds, half-crowns, and sixpences, of each an equal number, amounting to £8 1s. ; how many were there of each ?
6. Bring 46 acres, 2 rds. 22 pls. to square feet.

EXERCISE XXX.

1. Divide £9 among A B, C, giving A twice as much as C, and B 30 shillings more than A.
2. Suppose 3 lambs to weigh 1½ cwt. each, and to be worth 8½d. per lb., how much would a calf weigh to be equal in value at 8d. per lb. ?
3. If 15 men can do a piece of work in 4½ weeks, how many men will do the same kind of work in 13½ weeks ?
4. If a man earn 6s. per day, how long will he be earning £8 11s. ?
5. A cart weighs 9 cwt. 3 qrs., the load placed in it 1 ton 15 cwt. ; how much does one exceed the other, and what weight has the horse to draw ?
6. 300 persons attended a public meeting where a collection was made ; in the boxes were 2 half-crowns, 4 shillings, 16 sixpences, 20 four-penny pieces, and 16 pence ; what was the average contribution of each person present ?

EXERCISE XXXI.

1. How long will it take to walk from Reverton to Lake Tor, a distance of nineteen miles, at four miles an hour ?
2. How many halfpenny cakes can be purchased for £1 3s. 3½d.
3. Divide 1 mile by 3½ feet.
4. How many times does a wheel 9½ feet in circumference turn, in passing over four and a half miles.
5. Divide 6 acres. 3 rds. 28 pls. 23 yds. into six equal portions, and give the answer in square feet.

6. How many days, hours, minutes, and seconds, are there in December and January ?

EXERCISE XXXII.

1. At an election the successful member polled 2364 votes, which was a majority of 160 ; how many persons voted ?

2. What number must be added to two thousand and eighty-five to make it fifty-two thousand seven hundred and forty-seven ?

3. What change out of a £5 note must be received after paying for 16 railway tickets at 3s. 4½d. and four at 3s. 9d. each ?

4. If a factory turn out 5780 pens a day, how many will this amount to in a month of four weeks ?

5. Travelling a week at the rate of 150 miles a day at ¾d. per mile, how much did it cost ?

6. A wheelwright having 100 spokes made a set of waggon wheels with 12 spokes in each ; how many spokes had he left ?

EXERCISE XXXIII.

1. Having to travel 42 miles by rail at 1½ per mile, how much did it cost after paying 1s. for portorage and 3s. 6d. cab hire.

2. A father sending his son to sea gave him £20 ; his railway fare cost 25s., hotel bill 40s., outfit 15 guineas, and boat hire 5s. 6d. ; how much had he left ?

3. When butter is being sold at 1s. 3d. per lb., how much can be bought for 9s. 8½d. ?

4. Divide £824 17s. 6½d. by 23½d.

5. Bring 8461 scruples to ounces.

6. In 6 guineas, £4 18s., and fourpence, how many fourpenny-pieces ?

EXERCISE XXXIV.

1. To what number must thirty-seven thousand be added to make ninety-four thousand six hundred and ten ?

2. Five cottages and a garden cost £865 10s. ; the garden was worth £109 ; what was the cost of each cottage ?
3. 1053 letters were received at a post-office where 3 letter-carriers were employed ; how many to each ?
4. How many more chapters in the first four books of the Old Testament than in the four Gospels ?
5. Reduce 18 guineas, 16 pounds, 14 crowns, and 36 half-crowns to florins.
6. A baker offers to exchange 3d. loaves for a doz. yds. of calico at 4d. per yard ; how many loaves will be required ?

EXERCISE XXXV.

1. Cow, pig, horse, sheep, cost, say £50 : pig 17s. 6d., cow £21 2s. 4½d., horse 25 guineas ; find the cost of sheep.
2. A farmer employed a boy and a man, and agreed to pay the man 1s. 9d. per day, and the boy 1s. per day ; how much did their wages amount to in 26 days ?
3. What will 59 sheep cost at £3 17s. 6d. each ?
4. A gentleman leaves £965 1s. 10½d. to be divided among 89 charities equally ; how much did each charity receive ?
5. A field of 25 acres is divided into nine parts ; how much in six of them ?
6. A man had to walk 250 miles in 10 days ; he walks in each of the first 5 days 27m. 3f. 27p., how far would he walk in each of the remaining days ?

EXERCISE XXXVI.

1. The sum of two numbers is thirty-nine thousand four hundred and nine, the less is fifteen thousand one hundred and forty-six ; what is the greater ?
2. Find the cost of 105 eggs at 3 a penny.
3. How many strokes does a clock strike in 2 years of 365 days each ?

4. How much must be added to £100 in order to pay for the feed of 75 horses for three weeks, at 15s. per week for each horse?

5. After paying £1 5s. I give away half the money I have left, and then half of the remainder, and find I have 5s. left; how much had I at first?

6. From 16500 deduct 10 for every thousand, and multiply the difference by 904.

EXERCISE XXXVII.

1. What change ought I to receive out of a £5 note after paying for a suit of clothes £3 12s. 9d., and two pairs of boots at 12s. 6d. a pair?

2. Suppose 20 families to consist each of a man, his wife, and child, how much would be required to give every man 1s., every woman 6d., and every child 3d.?

3. A farmer having £500 to expend in cattle, he bought two horses at £43 15s. each, ten bullocks at £30 each; how many sheep can be purchased with the balance at £2 5s. each?

4. Bring 24660 halfpence to half-crowns.

5. A confectioner has to send out 100 buns; how many bags will he require, supposing each bag will take six? and how many will he have for the last bag?

6. To how many poor persons can you give 2s. 6d. each out of £16 17s. 6d.?

EXERCISE XXXVIII.

1. The difference of two numbers is forty-two thousand six hundred and four, the less thirty-one thousand and five; find the greater.

2. If a man and boy make 16 boxes an hour, how many will they turn out in a year, working 9 hours a day?

3. A field containing 38720 sq. ft. of land is to be sold for building; 4480 ft. will be required for the street and half as much for a back lane; how many houses can be built on the remainder, allowing 2000 ft. for each house?

4. If I buy 3 boxes of oranges, each containing 350, for £2 3s. 9d., and sell 500, what is the value of the remainder?

5. If I spend 13s. 6d. and put by 2s. 6d. every day, what is my annual income?

6. A gentleman receives £375 per annum and saves £20 per quarter; how much does he spend per week?

EXERCISE XXXIX.

1. A servant's wages were due the 6th of every month; how much did she receive at £14 3s. a year?

2. A porter carrying a dozen bottles of wine, which cost 36s., broke four bottles; two persons offered to share the loss with him; how much had each to pay?

3. A boy wishing to buy a violin with £1 5s., has saved 18s.; how much longer will it take to save the remainder at 3d. per week?

4. Multiply £84 19s. 7½d. by 4006½.

5. Divide 11 oz. 7 dr. 2 sc. 18 gr. by 16½.

6. Bring 16 qrs. 2 bush. 1 pk. 1 gal. 2 qrts. to pints.

EXERCISE XL.

1. What number must be added to five thousand eight hundred and fourteen to make it twenty-one thousand and six?

2. Divide £30 5s. 6d. among A, B, and C, giving C half as much as B, and B half as much as A.

3. Two trains start from the same station at 6 o'clock in the morning, and travel in the same direction; one goes 19 miles, the other 27 miles, an hour; how far will they be apart at 11 o'clock?

4. A person wishes to purchase seven articles at 3s. 6d. each in exchange for sixpenny books; what number will be required?

5. A and B made an exchange; A gave B 18 sheep at 35s. each, and B let A have a horse worth 35 guineas; how much money made up the difference, and by whom paid?

6. Find the cost of 1 cwt. of coal at 35s. per ton.

EXERCISE XLI.

1. I bought six teaspoons weighing 4 oz. for 25s., two tablespoons weighing $5\frac{1}{2}$ oz. for 34s. $4\frac{1}{2}$ d., and a gravy-spoon weighing $4\frac{1}{2}$ oz. for 28s. $1\frac{1}{2}$ d.; what did the spoons cost per oz.?

2. The hind wheels of a perambulator are 4 ft. 6 in. in circumference, the front wheel 2 ft. 6 in.; how many times does the front revolve more than the hind ones in passing over a road a mile long?

3. A horse and cart cost together £45, the horse is worth eight times the value of the cart; required the cost of each.

4. In 25 guineas, crowns, half-crowns, and shillings, how many sixpences?

5. Bring 2689 inches to yards.

6. Divide 63 tons, 18 cwt. 3 qrs. 18 lbs. 14 oz. 12 dwts. by 86.

EXERCISE XLII.

1. A work of 3 volumes, each of 240 leaves, is printed in double columns on each page; required the number of columns.

2. How much will seven gross of tape cost at 5 yards a penny?

3. How much will it cost to paint the fronts of six houses, each comprising 112 yards, at 1s. 4d. per yard?

4. A contractor employs 45 men at 3s. 9d. per day, 23 at 3s. 6d., and 17 at 4s. 6d.; what do the week's wages amount to?

5. A clerk is sent to pay and collect bills; he receives £2 4s. 6d., £8 15s. $4\frac{1}{2}$ d., £21 19s. $8\frac{1}{2}$ d., and pays away 40s., £1 10s., £5 18s. $10\frac{3}{4}$ d., 55s., and 9s. 7d.; how much does he bring home?

6. A schoolroom having an area of 1800 feet can accommodate how many scholars, reckoning 8 square ft. for each?

EXERCISE XLIII.

1. In a purse were sovereigns, half-sovereigns, half-crowns, and shillings, of each an equal number, the whole amounting to £10 1s. How many coins were in the purse?

2. A street, consisting of 26 houses on each side, was to be

numbered; the painter agreed to charge $1\frac{1}{2}$ d. each figure; required the cost.

3. How many packets of tea, $2\frac{1}{2}$ oz. each, can be made out of 28 lbs. 2 oz. ?

4. Divide 23 yds. 2 qrs. 2 nls. by 2 yds. 1 qr.

5. Find the gross weight of 19 parcels, each weighing 13 cwt. 1 qr. 17 lbs.

6. In 4910684 square feet, how many acres?

EXERCISE XLIV.

1. The yearly income of a gas company was £765; how many feet of gas must have been manufactured to realise this amount at 3s. 6d. per thousand feet.

2. A butcher retails the carcase of a sheep at $10\frac{1}{2}$ d. per lb., and receives £2 19s. 6d.; what was the weight of the carcase?

3. Divide £86 17s. 9d. among 35 persons, giving the first £6 16s. 6d. more than each of the others.

4. The town A is 35 miles from the town B. Jones, walking at the rate of 4 miles an hour, leaves A; at the same time Smith leaves B, walking 3 miles per hour; they walk towards each other; where and when will they meet?

5. How many books can be purchased for 15s. $5\frac{1}{4}$ d. if sold at 9s. 9d. per dozen?

6. How many packets of $2\frac{3}{4}$ oz. each can be made up from 1 cwt.?

EXERCISE XLV.

1. The baker's weekly bill for a family of 19 persons amounted to £1 19s. 7d.; how much was this for each?

2. It cost a guinea a week to maintain a man, woman, and child; the woman consumed half as much as the man, and the child half as much as the woman; how much did each cost?

3. A gentleman spent £5 in a jeweller's shop; he bought a chain for 18s., a ring for 17s. 9d., also a watch; required the cost of the watch?

4. Reduce £864 18s. 6½d. to halfpence.
5. Bring 25 guineas to half-crowns.
6. Bring 234568 square inches to acres.

EXERCISE XLVI.

1. A person counting his money in the dark thought he had £3 6s. 9d., but afterwards discovered he had mistaken a sixpence for a half-sovereign ; what was the exact amount ?
2. What will be the cost of 1000 books, supposing the printing cost 3s. 2½d. and the binding 9½d. each ?
3. Find the yearly income of a family, consisting of father, mother, and three children ; the father earns 17s., the mother 10s., and each of the children 4s. 6d. per week.
4. How many cubes of wood measuring 2 ft. each way would exactly fill a space measuring 36 ft. long, 15 ft. wide, and 13 ft. deep ?
5. How many yards of cloth at 15s. 6d. per yard can be purchased for £13 19s. ?
6. The destination of a ship is 1500 miles ; how long will the voyage occupy at the rate of 12 miles an hour ?

EXERCISE XLVII.

1. The tolls of a gate were, carriage 4d., horse 1d., pig ¼d., foot passenger ½d. ; what amount would be taken in one day, supposing there were 15 carriages, twice as many horses, four times as many pigs, and eight times as many passengers ?
2. How many pints would fill a 20-gallon tub ?
3. If a regiment consisting of 2360 men spent on an average every week 2½d. each in tobacco, what would be the total per year ?
4. In 2567845 inches, how many miles, fur., pls., &c. ?
5. Divide £421 18s. 0d. by 167½.
6. Multiply 2 y. 7 mo. 3 w. 5 d. 20 h. by 315.

EXERCISE XLVIII.

1. Divide a field measuring 8 a. 2 r. into 50 allotments.
2. A dealer purchased six bullocks at £25, and sixteen at £27 10s. each ; he paid £15 for keep, one bullock died, and the rest he sold at 31 guineas each ; how much did he gain or lose by the bargain ?
3. A road half a furlong has to be drained ; 36 yards of drain pipe are left from a former job ; how much more is required ?
4. Find the cost of 3 doz. pens, at 2s. 6d. per gross.
5. How many pieces, each $2\frac{1}{2}$ oz., can be cut from 25 lbs. 10 oz. of cheese ?
6. After paying for 27 lbs. of beef at $9\frac{1}{2}$ d. per lb., and 32 lbs. of mutton at $8\frac{1}{2}$ d. per lb., I have £3 2s. 9d. ; how much had I at first ?

EXERCISE XLIX.

1. A decanter and a dozen wine-glasses cost 15s. ; the decanter was worth 5s. ; what were the wineglasses each ?
2. A ton of coal cost £1 15s. ; what was this per cwt. ?
3. A lady ordered her grocer to send 20 poor women each 3 lbs. of sugar at $4\frac{1}{2}$ d. per lb., 4 oz. of tea at 4s. 8d. per lb., 4 lbs. of currants at 4d. per lb. ; required the amount of the bill.
4. Multiply 10 oz. 16 dwts. 18 grs. by 39, and give the answer in grains.
5. Find the value of one cwt of sugar at $4\frac{1}{2}$ d. per lb.
6. How many farthings will pay a bill amounting to £8 16s. $4\frac{1}{2}$ d. ?

EXERCISE L.

1. In a town of ten thousand people there are three thousand men and three thousand one hundred and nine women ; required the number of children, and how many more women than men ?
2. In a certain street a lamp is placed outside every tenth house. There are nine lamps. Tell how many more houses than lamps ?

3. In a basket of apples, pears, and nuts, there are 100 in all. Take the apples as 25, the pears as 30 ; how many nuts are there ?

4. Distribute £1 5s. among a class of nine boys, giving a double share to the first ; how much will each of the others receive ?

5. How much will it take to pay the wages of six men at 4s. each, and 3 boys half as much each ?

6. How many persons can be admitted to an exhibition for 10s. where the charge is 3d. each ?

EXERCISE LI.

1. A mother and child earned together at their needle 6s. per week ; the mother worked twice as fast as the child ; what was each one's share ?

2. A man bought a four-legged table, and was charged 2s. 6d. for one leg, double this amount for the second, and so on, to the fourth ; required the cost of the table.

3. In a mixed school of 120 children the girls were twice as many as the boys ; how many cap pegs would be required for the boys, and how many boots or shoes for the girls ?

4. In 25046716 square inches how many acres ?

5. Multiply 14 m. 3 fur. 15 pls. 3 y. 2 ft. 9 in. by 87.

6. Divide 6 tons, 2 cwts. 1 oz. by 6 lbs. 2 oz.

EXERCISE LII.

1. On parade were 156 soldiers, six of them were officers in charge ; how many men were under each officer ?

2. In a procession were six four-horse carriages, twelve single-horse cabs, and fifty-six saddle horses ; how many horses in all, and how many carriage horses ?

3. A woman, after selling a basket of oranges at $1\frac{1}{2}$ d. each, had 10s. 6d. ; how many oranges had she sold ?

4. What will 300 half-penny cakes cost ?

5. A traveller leaves home at 6 in the morning, walks four miles

an hour, rests half-hour each for breakfast and tea, one hour for dinner, and finishes his journey at 6 o'clock in the evening ; how far did he walk ?

6. How many farthing cakes can be purchased with 5s. $2\frac{1}{2}$ d.

EXERCISE LIII.

1. A person stole from a till a £5 note, two sovereigns, half-a-sovereign, and a florin ; he left £23 4s. 6d. behind ; what was the original amount ?

2. A woman gave a florin for $2\frac{1}{2}$ lbs. of beef, and received 4d. change ; what was the beef per lb.

3. A boy has 6 bags with an equal number of nuts in each ; he gives 30 each to two companions, and then finds he has four and a half bags left ; how many nuts had he at first ?

4. Bring 4 ac. 2 rds. 34 pls. 25 yds. to feet.

5. Bring 3492 weeks to years, and the odd weeks to seconds.

6. In 56491 farthings, how many pounds ?

EXERCISE LIV.

1. On a kitchen-dresser were 19 dishes, 33 plates, 14 glasses, 17 cups, 21 saucers, and 16 other pieces ; by how many did the highest exceed the lowest, and how many pieces were there in all ?

2. A gentleman pays his groom £50, servant-man £35, cook £14, housemaid £12, and page £6, per annum ; what is the total amount, and how much do the first two get more than the last two ?

3. Add together, £25, 25s., 25d., and 25 farthings.

4. A farmer bought 56 sheep of one person, 33 of another, and 129 of another ; on his way home he sold 42 ; how many had he left ?

5. A gentleman having £5 to distribute, gave £1 10s. to a charity, and divided the remainder among 28 poor families ; how much did each receive ?

6. Divide £8. 6s. equally among 6 men, 20 women, and 85 children, and tell how much each will receive.

EXERCISE LV.

1. A boy had 24 marbles in one bag, 34 in another, 12 in another, and 16 in each of two others. After losing one half of the whole, how many had he left?

2. In a public school are three hundred scholars; 150 pay $1\frac{1}{2}$ d., 100 pay $2\frac{1}{2}$ d., and the rest pay 4d. per week; required the total amount in farthings.

3. How many days, hours, and minutes are there in June, July, and August?

4. Multiply 2 m. 6 fur. 23 pls. 2 yds. 2 ft. 6 in. by 234.

5. Bring 824 half-crowns to guineas.

6. Divide £864 18s. $6\frac{1}{4}$ d. by £2 3s. 2d.

EXERCISE LVI.

1. Add together 33 gs., £26 4s., 36d., and 19 farthings.

2. A carpenter has in one drawer 106 nails, $4\frac{1}{2}$ doz. in another, and $2\frac{3}{4}$ doz. in another; after selling a dozen out of each drawer, how many has he left?

3. If there are 33 grains of wheat in an ear, and an acre of land can be sown with 5 pecks, how many bushels will seven acres produce?

4. Divide a thousand farthings among 150 children.

5. How much is left out of £1 after paying 2s. $3\frac{1}{2}$ d. for tea, 1s. for milk, 3s. $7\frac{1}{4}$ d. for cream, $7\frac{3}{4}$ d. for sugar, and 30d. for sundries?

6. A tea-dealer had two chests of tea, each weighing 1 cwt. 2 qrs.; having sold 1 cwt. 3 qrs. 17 lbs., how much has he left?

EXERCISE LVII.

1. A gentleman purchased a carriage for £50, a pair of horses at £25 10s. each, two sets of harness for £30 15s., and then sold the whole for £136 10s. 6d.; how much did he gain or lose by his bargain?

2. Suppose the telegraph posts be 120 feet apart, how many do you pass in travelling 100 miles.

3. A joint of butcher's-meat cost 14s. $7\frac{3}{4}$ d. at $9\frac{1}{2}$ d. per lb.? how much did it weigh?

4. Bring 64869 pints to quarters.
5. Multiply 100 oza. 16 dwts. 23 grs. by $203\frac{1}{2}$.
6. Divide £861 13s. 2d. by £2 5s. $6\frac{1}{2}$ d.

EXERCISE LVIII.

1. How many miles can I travel for 15s. at 3d. per mile?
2. Divide five guineas among 20 persons?
3. Multiply £71 9s. $8\frac{1}{2}$ d. by 109, 209, 319, and find the sum of the answers?
4. A servant left home with a £5 note to pay 17s. $6\frac{1}{2}$ d. to the butcher, £1 12s. 7d. to the grocer, 40s. to the baker, and 7s. 2d. for vegetables; what amount had she left?
5. John and Thomas were sent out to sell milk; John sold a pint to one person, a gallon to another, three pints to another, and a quart to another. Thomas sold half a gallon to one customer and one pint and a half to another; which sold the larger quantity, and by how much?
6. A child is 6 years 2 months old, the father is 6 times as old; find the difference in their ages?

EXERCISE LIX.

1. In a stone of potatoes were 60, which cost 1s. 3d.; one-half were bad, how much each were the good ones worth?
2. If I buy 10 yards of cloth at 5s. 9d. per yard, and have only 588 pence, how much more should I require to settle the bill?
3. A watch and chain together cost £13; the watch was worth three times as much as the chain; what was the value of each?
4. Bring 2346791 square feet to acres.
5. Multiply 36 tons, 19 cwts. 2 qrs. 18 lbs. 13 oz. 11 drs. by $17\frac{1}{2}$.
6. How much will it take to pay the following bills: baker's £4 16s. $8\frac{1}{2}$ d., butcher's £8 9s. 10d., grocer's £6 18s., tailor's 30s., and the draper's £5 0s. 6d.?

EXERCISE LX.

1. How long will a ship take to sail ten thousand miles at the rate of 250 miles a day ?
2. Divide £208 12s. 6d. among 5 men, giving one £8 12s. 6d. more than each of the others.
3. In a certain street are 15 houses ; each house has six windows in front and four behind ; how many windows are there in all ?
4. Divide 15 nuts, 25 oranges, 40 apples, and 65 plums, among five persons ; how many will there be for each person ?
5. How many shoes are required for 16 horses ?
6. How many hours are there in December and January ?

EXERCISE LXI.

1. Multiply four millions forty nine thousand and three by thirty-six thousand and twenty-nine.
2. Write in words 7106, 597084.
3. At an election for two members of Parliament one candidate had a majority of 201 out of 1135 votes ; how many voted for each ?
4. Multiply 8649102 by $16\frac{1}{2}$ and divide 8421 by $8\frac{3}{4}$.
5. How many ounces of tea at $4\frac{1}{2}$ d can be purchased for 48s. ?
6. What amount can be earned in a week by 56 men at 3s. 6d., 24 women at 2s. 6d., and 18 boys at 1s. 6d. per day ?

EXERCISE LXII.

1. How many toe and finger-nails have 19 children ?
2. If I have 40 bags of nuts, with 500 in one and 480 in each of the others, what is the total ?
3. A ship has on board 2751 tons of coal, another has 65041 cwts. ; how much has one more than the other ?
4. A gentleman bought two horses for £70 ; one was worth 6 times as much as the other ; find the value of each.
5. A village contained a population of five hundred and twenty,

from which emigrated 18 men, 22 women, and 62 children ; how many remained behind ?

6. Divide £24, 24s., 26d., and 24 farthings among 16 persons ?

EXERCISE LXIII.

1. How much is necessary in order to pay the following bills : Mr. Jones, £6 14s. 2½d.; Mr. May, £2 7s. 9d.; Mr. Smith, £8 6s. 9½d.; Mr. Evans, £18 2s. 10½d.; Mr. Thomas, £9 16s. 8d.; and Mr. Robins, £16 15s. 11¼d. ?

2. How much is left out of a £5 pound note after buying 12 lbs. of sugar at 6d. per lb., 10 lbs. of tea at 3s. 4d., 25 lbs. of currants at 10d., and a jar of preserved ginger at 4s. 6d. ?

3. Tell the weight of the following parcels :—the first, 3 cwts. 1 qr. 26 lbs.; second, 3 qrs. 16 lbs. 12 oz.; third, 6 cwts. 2 qrs. 11 oz.; fourth, 26 lbs. 6 oz.; fifth, 16 cwts. 1 qr. 18 lbs. 9 oz.; sixth, 3 qrs. 17 lbs. 5 oz.

4. Add together 12 lbs. 10 oz. 16 dwts. 20 grs.; 6 oz. 18 dwts. 23 grs.; 6 lbs. 8 oz. 14 dwts. 16 grs.; 24 lbs. 12 dwts. 19 grs.; and subtract 13 lbs. 11 oz. 8 dwts. 17 grs. from the result. ?

5. Add together 36 mo. 3 w. 6 d. 20 h. 50 m.; 2 w. 5 d. 18 h. 40 m. 56 s.; 20 mo. 1 w. 3 d. 18 h. 26 m.; 3 d. 40 s.; 9 mo. 3 w. 2 d. 21 h. 23 m. 45 s.; 6 w. 4 d. 19 h. 42 m. 23 s.

6. Find the difference between two hogsheads of sugar, one weighing 18 cwts. 3 qrs. 17 lbs.; the other 19 cwts. 1 qr. 6 lbs. 14 oz.

EXERCISE LXIV.

1. How many shoes would fit out 10 horses, 10 boys, and 10 donkeys ?

2. How many minutes are there in a week ?

3. A boy commenced a game with 20 marbles ; he won 6 from Jones and 9 from Smith, lost 3 to Williams and 7 to Robinson ; how many had he when he left off ?

4. Divide 16 lbs. of tea among 64 persons.

5. A lady had 3 £5 notes, 4 sovereigns, and 3 half-crowns ; she paid away £2 4s. 6d. to one person, 9s. 9d. to another, and gave 1s. to a poor man ; how much had she left ?

6. A corn-factor purchased 23 sacks of oats, each measuring 1 qr. 1 bush. 2 pecks; through an accident 9 qrs. 3 pecks were lost ; what quantity was left ?

EXERCISE LXV.

1. Add together 19 ac. 3 r. 35 p. ; 17 ac. 2 r. 27 p. ; 19 ac. 3. r. 16 p. ; 15 ac. 2 r. 29 p. ; 16 ac. 3 r. 36 p.

2. Find the sum of 23 gals. 2 qts. 1 pt. ; 27 gals. 2 qts. 1 p. ; 26 gals. 3 qts. 1 p. ; 25 gals. 2 qts. 1 pt. ; 27 gals. 3 qts. Take 19 ac. 2r. 30 p. from 96 ac. 3 r. 4 p.

3. Find the sum of 19 yds. 10 ft. 7 in. ; 3 yds. 7 ft. $9\frac{3}{4}$ in. ; 2 yds. 8 ft. $10\frac{1}{2}$ in. ; 7 yds. 11 ft. $8\frac{1}{2}$ in. Take 96 yrs. 10 mo. 3 wks., from 112 yrs. 9 mo. 2 wks.

4. In $19358\frac{1}{2}$ days, how many years of 365 days 6 hours each ?

5. An estate has 7649 oak trees, 721 elms, 5073 beeches, 719 ash and 838 poplar trees; if 24 be cut down daily, how long will it take to cut them all down ?

6. The population of Ireland in 1861 was 5798965, and in 1870 it was 5519641 ; what was the annual decrease ?

EXERCISE LXVI.

1. Which will cost more and by how much, 150 sheep at 30s. each, or 13 bullocks at £25 5s. each ?

2. A woman had 2 doz. and 4 apples in one basket, 3 doz. in another, 20 in another, and $1\frac{1}{2}$ doz. in another ; she sold 10 each to three boys and 14 to a man ; how many had she left ?

3. How much will it take to pay 15 weeks' wages to 6 men and 3 boys, the men being paid 4s. and the boys 2s. 6d. each per day ?

4. In a school are 120 pupils ; one half pay 2d. per week, 20 pay 1d. and the rest $1\frac{1}{2}$ d. each ; find the total sum.

5. Distribute £61 14s. 9d. equally among 50 persons.

6. How many more hours are there in July and August than in April and June?

EXERCISE LXVII.

1. Write in words 400040040; also the difference between one hundred and one and a million.

2. Divide the sum of 7986, 8975, 3998, 976, 5899, 379, 5764, 7788, 9787, 377, 9789, 789, 6539, 365, by 34.

3. How much will be left out of £160 after paying the following amounts: £18 17s. 9d., £16 11s. 4d., £18 9s. 11d., £82 14s. 6d., £12 16s. 4d., £4 3s. 7d.?

4. An Englishman died in Australia 60 years of age; he had lived in France 5 yrs. 3 mo. 2 w.; Spain, 17 yrs. 13 d.; Egypt, 2 yrs. 6 mo. 1 w.; Cape Town, 1 yr. 7 mo. 3 w.; India, 4 yrs. 2 w.; Australia, 10 yrs. 2 mo. 1 w. 4 d. At what age did he leave England?

5. Add together 84 tons 16 cwt. 3 qrs. 18 lbs.; 1 ton 19 cwt. 2 qrs. 14 lbs.; 56 tons 13 cwt. 3 qrs. 22 lbs.; 19 tons 18 cwt. 2 qrs. 16 lbs.; and subtract 2 tons 2 cwt. 2 qrs. 2 lbs. from the result.

6. Six persons travelled respectively 12 m. 2 f. 39 p.; 15 m. 1 f. 19 p.; 17 m. 1 f. 10 p.; 19 m. 2 f. 14 p.; 14 m. 2 f. 16 p.; 122 m. 1 f. 2 p.; what was the average distance travelled by each?

EXERCISE LXVIII.

1. In a loft were six sacks of meal containing 2 qrs. 3 bush. each; a thief took $1\frac{1}{2}$ bush. out of each sack; how much remained?

2. In a street of 42 houses on each side there resided on an average 16 persons in each house; what would it cost to maintain them all for a week, reckoning 3 meals a day for each person, at 9d. a meal?

3. Divide 33 shillings among 15 girls, giving the first 1s. more than the second, and the second 1s. more than each of the others; say how much each would receive.

4. Divide 1 qr. 20 lbs. 13 oz. of sugar among 72 persons.

5. Find the cost of 3 horses at £45 10s. 6d. each, 4 carts at £15 2s. 9d. each, and a waggon at £25 15s.

6. A man buys five bank shares for £105, and sells them again at £22 0s. 6d. each ; what profit does he make ?

EXERCISE LXIX.

1. Divide 7890609 by 42, by long division, also by its factors, and prove by multiplication.

2. How many days will 312 lbs. of beef last a family of 13 persons, if each person eat $1\frac{1}{2}$ lbs. per day ?

3. Multiply £864 18s. $6\frac{1}{4}$ d. by 84, and take one half of £18 4s. $6\frac{1}{2}$ d. from the product.

4. Multiply 16 tons 2 cwts. 1 qr. 18 lbs. by 36, and divide the product by 6.

5. Multiply the difference between 28 lbs. 16 dwts. 23 grs. and 23 lbs. 2 dwts. 19 grs. by 96.

6. Divide 155 cwts. 3 qrs. 13 lbs. by 46, and multiply the quotient by 4.

EXERCISE LXX.

1. Divide 39 shillings, 13 florins, and 65 penny-pieces among 13 persons ; how many coins will each receive, and what will be their value ?

2. If $\frac{1}{2}$ doz. chairs cost 15s. each, and a table £2 10s., what change must be given out of two £5 notes ?

3. A father dying left £550 among his 3 sons and 2 daughters ; how much did each receive ?

4. A boy exchanged 20 apples at 4 a penny for 6 eggs at $1\frac{1}{4}$ d. each ; how much money had he to pay ?

5. Marbles being sold 12 a penny, how many can I buy for $4\frac{3}{4}$ d. ?

6. First, second, and third-class fares on a certain railway are $2\frac{1}{2}$ d., $1\frac{1}{2}$ d., and 1d. respectively. Suppose I travel 120 miles, one half by first, the other half by second class, what will it cost ? and how much less to travel all the distance by third class ?

EXERCISE LXXI.

1. A boy had 2348 nuts ; he takes six dozen for himself, then divides the rest among 19 schoolfellows, keeping those remaining over for himself ; how many had the first boy, and how many each had the others ?

2. Divide 260 oranges among 3 boys, giving to A 20 more than B, and to C 10 more than A.

3. Multiply £361 16s. $4\frac{1}{2}$ d. by 126, 204, 680.

4. 18 a. 3 r. 24 p. by 24, 54, 108.

5. Divide £2641 18s. $6\frac{3}{4}$ d. by 214, and 1569 cwt.s. 3 qrs. 7 lbs. by 126.

6. Make out a bill for the following articles : $16\frac{1}{2}$ lbs. loaf sugar at $6\frac{1}{2}$ d. per lb. ; 23 lbs. of moist sugar at $4\frac{3}{4}$ d. per lb. ; 18 lbs. raisins at $5\frac{1}{4}$ d. per lb. ; 12 lbs. currants at $3\frac{1}{2}$ d. per lb. ; 2 doz. of sherry at 30s. 6d. per doz. ; packing case, 1s. 6d. ; carriage, 3s. 2d.

EXERCISE LXXII.

1. A man 35 years of age, his wife 32, their eldest son 15, eldest daughter 12, and four younger children $9\frac{1}{2}$, $7\frac{1}{4}$, $2\frac{3}{4}$, and 6 months respectively ; required the sum of their ages and the average age of the family.

2. John and Thomas commenced a game of marbles with ten each ; John won 6 and afterwards lost 9 ; how many had each at the close of the game ?

3. Divide 1 qr. 20 lbs. 13 oz. of tea among 72 persons.

4. In one cart were 3 tons 1 cwt. 2 qr., in another 5 tons 18 lbs., in another 1000 lbs., and in the last 35 cwt. 3 qrs. ; find the whole weight, and by how much the greatest exceeds the least.

5. If I receive £2 4s. 6d., five guineas, six half-crowns, and pay away 40s., 17s. 9d., £1 0s. 4d. and 1s. 9d. ; how much shall I have left ?

6. How many pieces of cheese, 13 oz. each, can be cut from 9 lbs. 6 oz. ? And give the weight of the last piece.

EXERCISE LXXIII.

1. There are about twelve hundred and twenty-two million people in the world ; if this number die in 34 years, by how many do those dying every year exceed the population of the British Isles, which is 30937487 ?

2. A truck weighing 1 ton 6 cwts. 1 qr. contains 19 bales of goods, each weighing 140 lbs. 10 oz. ; find the gross weight.

3. A letter-carrier delivers letters three times a day, except Sundays, walking $7\frac{1}{2}$ miles each delivery ; how far does he walk in 25 years, omitting leap-years ?

4. To extend a railway 238 houses were removed, at an average cost of £678 14s. 6d. ; find the sum total.

5. Divide £30324 4s. $1\frac{1}{2}$ d. by 234, and multiply the quotient by 305.

6. Multiply 28 yds. 3 qrs. 3 nls. by 127, and prove it by long division.

EXERCISE LXXIV.

1. Out of a barrel were drawn 4 qts., 2 gals., 1 qt. and 7 pts. ; there was left 3 gals. 1 qt. 1 pt. ; how much was in the barrel at first ?

2. How many men at 30s. per week can I employ for 4 weeks for £114 ?

3. Out of a bag of money I paid 103 workmen £1 2s. 6d. each, and had £5 2s. 4d. left ; how much was put into the bag ?

4. Having a chest of tea weighing 1 qr. 26 lbs., I take out sufficient for seven packets, each weighing 2 lbs. 13 oz. ; how much is left ?

5. Find the value of a wardrobe consisting of 3 coats at £1 10s. each, six pairs of trousers at 10s. 3d. each, and 14 vests at 5s. 6d. each.

6. How long will it take to fill a cistern holding 500 gallons, supposing it be supplied with 3 taps, letting in $12\frac{1}{2}$, $7\frac{1}{2}$, and 5 gallons respectively per minute ?

EXERCISE LXXV.

1. What number multiplied by 78079 will give as product 89 times the difference between 97869023 and 97654786 ?

2. A gentleman uses 13 doz. of sherry every month at £2 2s. per doz. ; 4 doz. of claret per week at £1 10s. per doz., and 3 doz. of port every fortnight at £2 10s. per doz.; how much has he left out of an income of £1000 a year after paying his wine bill ?

3. The gross rent of a farm at £3½ per acre is £962½; find the number of acres; and if the rent were increased to £4 16s. per acre what would the rent then be ?

4. Divide 129 tons 16 cwts. 1 qr. 18 lb. 10 oz. 13 drs., by 234, and subtract the quotient (omitting the remainder) from 200 tons ?

5. During 1867 the letters delivered in the British Isles were 774831000, and during 1868, 808117968. If the letters were delivered daily, except Sunday, Christmas-day and Good Friday, what was the increase per day during the year ?

6. Make an invoice for the following articles : 56½ yds. of silk at 4s. 11d. per yd., 48 yds. of hessian at 7¼d. per yd., 25½ lbs. of fingering at 3s. 6½d. per lb. ; 120 yds. of cashmere at 4s. 2¾d. per yd., 75 English ells of ducape at 4s. 9d. per ell., 38 metres of saracenat at 21½d. per metre.

EXERCISE LXXVI.

1. Divide one acre into 15 garden-plots, and give the contents of each.

2. Subtract 6½ doz. from 1½ gross.

3. A farmer bought 3 flocks of sheep consisting of 56 at 33s. each, 84 at 29s. 6d. each, and 27 at 35s. 9d. each ; afterwards he sold them at 34s. 3d. each ; how much was his profit ?

4. A ship having a crew of 86 men, the captain's wife, and 236 passengers, was wrecked ; 19 of the crew and 156 passengers were drowned ; how many were saved ?

5. An orchard containing 45 cherry-trees produced on an average 1 cwt. 2 qrs. 16 lbs. each ; one dealer purchased 1½ tons, another 15 cwts. 15 lbs. ; how many were unsold ?

6. How much will be left out of four £5 notes after paying for 3 chairs at 23s. each, lounge 3 guineas, table £4 10s., and a pier-glass £5 19s. 7d. ?

EXERCISE LXXVII.

1. A postman delivered twice as many letters on Monday and half as many again on Saturday as on any other day of the week; if his weekly deliverage be 8505, how many does he deliver on Saturday ? (Omit Sunday.)

2. Two ships were wrecked: one ship lost half her crew, 46 men, the other lost 213; the number saved of the first ship was twice as many as the number saved of the other; how many men sailed in each ship ?

3. Divide £3648 15s. among two sons and three daughters, giving to each of the latter twice as much as to each of the former.

4. Divide 325 tons of coal among 1000 poor persons, and find the cost at 28s. 6½d. per ton.

5. What weight of sugar would be required to make up 421 parcels, each weighing 2 qrs. 18 lbs. 14 oz.

6. Make out a bill for the following articles: kitchen stove, £8 10s.; 18½ doz. ivory-handled knives, at 32s. 6d. per doz.; 16¼ doz. small ditto, at 20s. 6d. per doz.; three sets of polished fire-irons, at 19s. 6d. per set; 23 doz. plated forks, at 24s. 9d. per doz.; cruet set, £2 10s. 6d.; hot-water jug, 15s. 9d.

EXERCISE LXXVIII.

1. Divide £1 0s. 0½d. among poor children, giving 3¼d. to each; find the number.

2. How many yards of calico can be purchased for 15s. at 4½d. per yard ?

3. Divide £3 1s. 6d. among 20 persons, giving the first half as much again as each of the others.

4. A house of 23 rooms; eleven have 3 windows each, six have 2

windows each, and the rest one window each; how many windows in all?

5. How much will it cost to provide 156 poor persons with dinner at $2\frac{1}{2}$ d. each.

6. A father left an estate consisting of 1600 a. 2 r. to his two sons and three daughters; the sons were to have between them as much as the three sisters; what quantity had each?

EXERCISE LXXIX.

1. Multiply fourteen thousand two hundred and thirty-one by thirteen thousand two hundred and twelve.

2. Multiply the difference between 310342 and 2774 by 540900, and find the product of 87648107 and 794.

3. The sum of two numbers is 17264, and the greatest number is 9999; what is the product?

4. Three partners commenced business with £20000, and after trading together for 17 years dissolved partnership; what had each to receive? The profits were £560 each year for the first six years, and £759 a year afterwards.

5. Find the value of $\frac{3}{4}$ ths. of 921306, and $\frac{1}{2}$ ths. of 31670021.

6. How often is 123 contained in 876543? Divide £333 6s. 8d. by $3\frac{1}{2}$.

EXERCISE LXXX.

1. Find the cost of $7\frac{1}{2}$ tons of coal at 1s. $3\frac{1}{2}$ d. per cwt.

2. It cost £5 12s. to glaze 16 windows, having 12 squares of glass in each; what was this per square?

3. A gentleman gave 60 guineas for a horse, and sold it again on condition that he was paid for the nails of the shoes only, reckoning four in each, and charging $\frac{1}{4}$ d. for the first, $\frac{1}{2}$ d. for the second, and so on, doubling the price for every successive nail; how much did the gentleman gain or lose by the bargain?

4. Add together 85 guineas, 35 half-crowns, and 56 groats.

5. A milkman started on his rounds with 44 gals. $3\frac{1}{2}$ qts. of milk; after adding 5 gals. 1 pt. of water he supplied 100 customers in equal quantities; how much did each receive?

6. How much must a man put by per day in order to save £20 3s. $0\frac{1}{4}$ d. in the course of a year?

EXERCISE LXXXI.

1. By how much does 50 guineas exceed £25 10s. $6\frac{1}{2}$ d? What is the difference between £30 and 19 guineas.

2. If 113 lbs. cost £119 4s. $9\frac{1}{4}$ d. what is the cost of 1 lb.? Divide £1901 2s. $2\frac{1}{4}$ d. into 99 equal portions.

3. A person sends a £20 note to discharge a bill, and receives in change £4 14s. 6d.; what was the amount of the bill? Divide 186 acres 3 rds. 36 pls. among 13 persons.

4. Two trains start from the same place at the same time, in opposite directions; one travels at the rate of 25 miles, the other 35 miles, an hour. How far will they be apart in $6\frac{1}{2}$ hours?

5. A servant's wages are 12 guineas a year; having received in part £7 19s. 6d. what remains due? Multiply £923 17s. $8\frac{1}{2}$ d. by 89, and divide the product by 33.

6. Sold, six lots of standing corn, which measured 3 a. 2 r. 19 p.; 4 a. 3 r. 26 p.; 4 a. 1 r. 33 p.; 5 a. 2 r. 23 p.; 2 a. 3r. 19 p.; and 3 a. 2 r.; required the price, at £12 per acre.

EXERCISE LXXXII.

1. A fortune of sixteen thousand five hundred pounds was left to a family of 10 daughters, each of whom had a brother; all were to share alike; how much did each receive?

2. In a certain hospital on Monday were 28 men, 14 women, and 19 children; 16 other patients were received during the week, 5 died, and 13 discharged; how many remained in the institution on the following Monday?

3. Divide 6 baskets of apples, each containing 36, equally among 18 children.

4. A shooting party, at the close of a day's sport, brought home 234 head of game, and found that on an average they had shot 18 each ; how many were there ?

5. After paying away one-half of the contents of my purse and a sovereign in addition, I had £3 left ; how much had I at first ?

6. A man being called in to sweep the chimneys of a house, charged 2s. 6d. for the kitchen, 2s. for the drawing-room, 1s. 6d. each for the two parlours, and 1s. each for the bedrooms ; he was paid 13s. 6d. ; how many bedrooms were there ?

EXERCISE LXXXIII.

1. The dividend is four hundred and nineteen millions three hundred and twenty thousand and four, the divisor is six hundred and twenty-seven thousand and fourteen. Required the quotient.

2. Bought 24 yds. of muslin, out of which I sold two dresses of 8 yds. 2 qrs. 2 nls. each ; what quantity had I left ?

3. If a gentleman's income is £1265 6s. 8d. a year, how much may he spend per week, and per day, so as to save one quarter of it ?

4. Divide £90 6s. 10½d. equally among 35 persons, and find how much three of them will receive.

5. Reduce £48 12s. 2½d. to halfpence. In 35153 farthings how many pounds shillings and pence ?

6. In £120 10s. how many crowns and pence ? In £56 2s. 6d. how many half-crowns and sixpences ?

EXERCISE LXXXIV.

1. In a house were 37 gas burners, which were charged £3 10s. 1½d. for the quarter ; how much was this for each burner per week ?

2. A bookseller ordered 10 dozen books at 6s. 5d. per dozen ; he was allowed 13 to the dozen, but 20 books were lost in transit ; what must he charge for each book so as to clear 2d. by it ?

3. Bring to half-crowns 5 guineas, 36 sovereigns, and 30 sixpences.

4. The week's pence of a public school amounted to 27s. 3d., the

charge was 3d. per week ; 6 omitted to pay, and 15 were absent ; how many pupils did the school number ?

5. I wish to divide 1 cwt. of sugar into packages of $1\frac{1}{2}$ lb., 1 lb., $\frac{3}{4}$ lb., $\frac{1}{2}$ lb., $\frac{1}{4}$ lb., and of each an equal number ; how many will there be ?

6. Took a railway ticket for 124 miles, paid a £1, and received 4s. 6d. change ; how much was I charged per mile ?

EXERCISE LXXXV.

1. A father left a farm of 37 acres to be divided equally among his children, each of whom received 7 a. 1 r. 24 p. How many children were there ?

2. In £19 how many pence and halfpence ? Reduce £365 8s. to halfpence.

3. Reduce 2 cwts. 2 qrs. 8 lbs. 5 oz. 9 drs. to drs., and 3196800 cubic inches to cubic feet.

4. In 4320 halfpence how many sixpences ? In 63840 pence how many crowns ?

5. Change 2268 groats into shillings and guineas ; and £840 into guineas.

6. Make out a bill for the following articles : 5 yds. of lawn at 2s. 6d. per yd. ; 12 yds. of silk, at 14s. 3d. per yd. ; 9 yds. of cambric at 5s. 2d. per yd. ; 3 yds. of velvet, at 24s. 6d. per yd. ; 15 yds. of brocade, at 15s. 3d. per yd. ; 27 yds. of lace, at 12s. 2d. per yd.

EXERCISE LXXXVI.

1. In a purse are 2 sovereigns, 3 half-sovereigns, 7 half-crowns, a florin, and fourpenny piece ; if all these were exchanged for halfpenny pieces how many would there be ?

2. A shopman offered 100 articles at 8s. 6d. per dozen, and 2d. off each article for cash ; how much money would be required ?

3. A grocer buys 6 cwts. 2 qrs. 14 lbs., of sugar ; one half he sells at $6\frac{1}{2}$ d. per pound, the other half he sells wholesale for 8 guineas, and then clears £1 5s. by the bargain ; what was the original cost ?

4. If 3 barleycorns reach one inch, how many would reach a mile ?

5. Sitting-room has to be provided for 200 persons ; the only seats to be had are forms which accommodate 6 persons ; how many forms must be used ?

6. How much will it cost a man to insure his life for £1000 at £4 3s. 6d. per cent. per annum ?

EXERCISE LXXXVII.

1. If a person walk 5475 miles in a year, how many miles is that per day ? Divide £26980 among 284 men.

2. The interest of the national debt is £22792594. How many poor families would this support for the year, supposing each family to consist of father, mother, and 3 children, allowing for each parent £8 for the year and £4 for each child ?

3. In 17 guineas, pounds, shillings, and pence, how many farthings ? Bring 2349 half-guineas to half-crowns.

4. Reduce 37 lbs. 2 oz. 7 drs. 2 sc. 12 grs. to grains.

5. In 11,616 nails how many yards ? In 365 English ells 2 qrs. 3 nls. how many nails ?

6. A silversmith melted some silver weighing 5 lbs. 0 oz. $\frac{1}{2}$ dwt., and made it into spoons, each weighing 2 oz. $12\frac{1}{2}$ dwts. ; how many were there ?

EXERCISE LXXXVIII.

1. What will 3 bottles of wine cost, at 36s. 6d. per dozen ?

1. What sum added to £3 19s. 9 $\frac{1}{2}$ d. will make £5 ?

3. A ship, manned by a captain, mate, and 15 men, fell in with a prize worth £650 ; the captain received one-half as his share, the mate one-fifth of the remainder, and the rest was equally divided among the crew ; how much did each person receive ?

4. A tradesman selling off offers his goods at a reduction of 2s. 6d. in the pound ; what sum must be paid for a parcel the usual price of which is 10 guineas ?

5. How many pint-and-a-half bottles can be filled from the contents of a 36-gallon cask ?

6. The rent of a house is £4 7s. 6d. per quarter, out of which 5s. a year is paid for insurance and £2 10s. for repairs ; what will the clear income amount to in ten years ?

EXERCISE LXXXIX.

1. If a servant's wages be 7s. 9d. per week, what is that per year ?

2. If I save half-a-guinea a day, what will it amount to in a year ?

3. In 15346907 oz. how many tons, &c. ? In 569705 sq. ft. how many acres, roods, &c. ?

4. How often will a coach-wheel turn in going a distance of 30 miles, its circumference being 3 ft. 9 in. ?

5. Divide 4 m. 5 fur. 179 yds. by 2 fur. 22 yds. 6 in., and 141 days 3 hrs. 4 m. by 17 days 15 hrs. 23 m.

6. A cistern holding 10000 gallons is filled by two pipes, one discharging 9 gallons per minute, the other 8 gallons ; the cistern leaks one gallon per minute ; how long will it take to fill after the water is let on ?

EXERCISE XC.

1. Out of an annual income of £750 how much left for daily expenditure after saving nineteen guineas per quarter ?

2. How many families, each consisting of seven persons, can be maintained for a week for £100, supposing each person to cost 3s. per day ?

3. 1200 persons attended a concert ; one-fifth paid 7s. 6d., one-third 5s., and 560 2s. 6d. each ; how much were the proceeds ?

4. If 4d. per quart be given for milk, and one quart of water be added to 3 quarts of milk and sold at the same price, what profit is made on the sale of 20 gallons ?

5. Three sisters purchased between them a carriage for 150

guineas, a pair of horses at £45 each, harness, &c., £35 10s. ; what was each sister's share of the cost ?

6. A vessel being worth £13420, a man purchases a seventieth share of her ; how much has he to pay ?

EXERCISE XCI.

1. A line of railway 344 furlongs in length, 276 furlongs were completed at a cost of £393 16s. 4½d. per furlong, the remainder £433 9s. 11d. per furlong ; required the total expense.

2. Sold a quarter of wheat at 9s. 11d. per bushel, and 1 cwt. of sugar at 11½d. per lb. ; what was the amount of the bill ?

3. If my income be £1 18s. 6d. per day, what is that per year ?

4. Reduce 37 a. 3 rds. 25 pls. 26 sq. yds. to square yards ; and bring 35 guineas to half-crowns.

5. From one thousand pounds take £216 14s. 3d., multiply the remainder by 76, and divide the product by 29.

6. Make out an invoice for the following goods : 24 reams of demy at £2 12s. 6d. per ream ; 75 reams of wove post at £2 per ream ; 27 reams of crown at £1 13s. per ream ; 13 reams of hot pressed at £2 3s. per ream ; 52 reams of foolscap at £1 5s. 6d. per ream ; 71 reams of thin post at £1 8s. 9d. per ream.

EXERCISE XCII.

1. Iron railings weighing 8 cwts. 1 qr. 20 lbs. were fixed at 1s. 3d. per lb. ; what was the cost ?

2. What would be the total length of 3 bales of cloth, each containing 16 pieces, at an average length of 26½ yards ?

3. If I take 4½ miles exercise a day, how many miles do I walk in the year ?

4. A baker took in one week £3 5s. 9½d. for halfpenny cakes ; how many did he sell ?

5. In a double-column page of print there were 72 lines of 9 words in each column ; how many words in six leaves ?

6. What would be the average number of deaths in a town of 10500 inhabitants, where the mortality is usually 2 per cent. per annum?

EXERCISE XCIII.

1. If a person travel 12 miles per day, how many miles will he travel in seven years (omitting leap-year)?

2. What is the weight of 6 bars of silver, each weighing 3 lbs. 10 oz. 8 dwt. 16 grs.?

3. What sum was divided among 24 persons, so that each had £833 6s. 8d? Divide £4 11s. by 112.

4. Divide £100 between two persons, giving one £12 0s. 6d. more than the other. Find one-twelfth of the difference of their shares.

5. In 40320 grains how many scruples, drams, ounces, and pounds? How many scruples in 321 lbs. 5 oz. 2 drs. 2 sc?

6. How many days from May 1st till November 1st? How many hours from May 20th till September 29th?

EXERCISE XCIV.

1. Find the sum, difference, and quotient of £86 4s. 9d. and £26 9s. 9d.

2. Divide 11s. 3d. among 20 boys, giving the first twice as much as the second, and the second half as much again as each of the others. How much will the first, second, and each of the others receive?

3. A bankrupt can only pay 10s. in the pound, or half the amount he owes. To Mr. A. he owes £125 10s. 9d.; to Mr. B. £74 5s. 7d.; and to Mr. C. £518 19s. 4d. How much will each receive?

4. The following subscriptions were received, to be equally divided between three charitable institutions: £5 4s. 9d., £8 9s. 3d., £15 6s. 2d., £18 4s. 7d., £24 0s. 9d.; how much would each receive?

5. A doctor visits 26 patients daily, each of whom pays him seven guineas per quarter; find his annual income.

6. A master and six of his men do a piece of work which costs £11 5s. ; the master receives half as much again as each of the others ; find each one's share.

EXERCISE XCV.

1. How often will a coach-wheel 8 ft. in circumference turn round in passing over 15 miles ?

2. In 2831 acres how many yards ? Multiply £3 11s. 6d. by $93\frac{1}{2}$.

3. One cubic foot of water weighs 1000 oz. ; what will be the weight of water contained in a cistern holding 100 cubic feet ?

4. How many half-crowns, shillings, and farthings, of each an equal number, are there in £21 6s. $0\frac{1}{4}$ d. ?

5. How many roubles, each worth 3s. 4d., are equal in value to 500 napoleons at 17s. 6d. each ? Multiply £3 19s. by $99\frac{1}{2}$.

6. A tea-dealer mixes 8 lbs. of tea at 3s. 6d. ; 12 lbs. at 2s. 4d. ; 10 lbs. at 3s. ; 9 lbs. at 3s. 10d., and 6 lbs. at 4s. 2d. ; how much should be charged for a pound of the mixture ? Multiply £3 4s. by $103\frac{3}{4}$.

EXERCISE XCVI.

1. A carrier charged 1d. per lb. for 10 miles ; what would be the carriage for 2 cwts. 1 qr. for 60 miles ?

2. How much would be the annual cost to a family of nine persons for shoes, supposing each one had a pair at 12s. 6d. every six months, and the repairs for the whole were 32s. 6d. ?

3. Suppose a halfpenny to be one inch across, how many, side by side, would reach a mile, and what would be their value ?

4. A ship worth £1600 is wrecked ; the cargo is worth £2740, one-half of which is saved, and the broken ship is sold for one-twentieth its original cost ; find the total amount of loss.

5. A house of sixteen rooms is let out at 1s. 3d. per week each ; the rates and taxes are £7 per year, and repairs £5 ; how much is the clear annual rental ?

6. A woman had 100 eggs ; she sold the first 50 at 1d. each, and the remainder at 5 for 4d. ; how much did she get for her eggs ?

EXERCISE XCVII.

1. How many farthings will discharge a debt of £3 17s. 8d. What will be their weight if 8 farthings weigh 1 oz. ?

2. How often will a wheel $3\frac{1}{4}$ yards in circumference turn between London and Plymouth, a distance of 246 miles ?

3. Find the circumference of a wheel which revolves 1848 times in a journey of $3\frac{1}{2}$ miles. Multiply £1 7s. 6d. by 111 $\frac{1}{2}$.

4. Divide 859 yds. 2 nls. by 9 yds. 3 qrs. 2 nls., and 160 a. 1 r. 37 p. by 17 a. 3 r. 13 p.

5. A merchant pays £430 9s. per annum to his clerks ; how many are there, supposing they receive on an average £71 14s. 10d. each ? Divide 107 tons 17 cwt. 2 qrs. by 46 $\frac{1}{2}$.

6. Make out a bill for the following articles : 10 gallons of sherry at 16s. 8d. per gallon, 7 gallons of Oporto at 13s. 6d. per gallon ; 13 gallons of claret at 12s. per gallon ; 9 gallons of Malaga at 11s. 3d. per gallon ; 4 gallons of Lisbon at 14s. 6d. per gallon ; 15 gallons of brandy at £1 4s. 6d. per gallon.

EXERCISE XCVIII.

1. A sum of money was divided between A, B, C, and D ; A had twice as much as D, and C had twice as much as A, and B had thrice as much as C. D's share was £6. What was the sum of money divided ?

2. How many times may 142 be subtracted from 3834 ?

3. How often will a wheel, whose circumference is 8 feet, turn in passing over a road a mile long.

4. If a railway train leaves a certain station at 9 A.M. and reaches another 175 miles distant at 4 o'clock, how many miles an hour is the speed ?

5. A train leaves Plymouth for London at 10 A.M., and travels 2

miles an hour; another train leaves London for Plymouth at the same hour, travelling 25 miles an hour; when and at what distance from London will they meet? London to Plymouth is 225 miles.

6. What number multiplied by 52 will produce the same result as 338 multiplied by 176?

EXERCISE XCIX.

1. In 10000 gallons how many quarters, &c.? In 158400 feet how many furlongs?

2. Reduce 6001567 half-crowns to fourpenny pieces, and £5271 to guineas.

3. Bring £36 5s. 7½d., 1s. 9d., 7½ guineas, 3s. 1¾d. to the same denomination; add the first three together, and divide the sum by the fourth.

4. A truck with its load of 10 equal packages weighs 2 tons 1 c. 2 qrs. 14 lbs.; if the truck weigh 1 ton 2 c. 16 lbs., find the weight of each package? Multiply £4 6s. 8d. by 124½.

5. If 1 cwt. cost £3 0s. 8d., what will 1 lb. cost? What must I lay by per day to save £150 3s. 7¾d. a year?

6. An equal number of men, women, and boys earned £25 10s., in a week, the daily wages of a man being 1s. 4d., a woman 10d., and a boy 4d.; how many were there of each?

EXERCISE C.

1. A cistern holding 356 gallons, is supplied by two taps discharging 9 and 10 gallons per minute respectively; there is another tap to empty the cistern, which discharges 7 gallons per minute if all three taps are left open; what time will it take to fill the cistern?

2. In a certain town there died in one year 896; this was one in every 75 of the inhabitants; how many were there?

3. Suppose it was resolved to raise a militia regiment consisting of 50024 men, to be equally divided between the 52 counties of England and Wales; how many would this be for each?

4. How long could a person be boarded for £61 8s. 6d. at a guinea and a half a week ?

5. A person has to pay 7d. in the pound income tax ; his income is £320, and he pays £10 ; what mistake has been made ?

6. How many pieces of cloth 3 yds. 1 qr. 1 nl. long can be cut from 135 yds. 3 qrs. 1 nl. ?

SECOND PART.

WHEN a class has thoroughly mastered the first four rules (including Reduction) of arithmetic, I pass on to Vulgar and Decimal Fractions, and find from long experience that in this way two valuable results are secured : *first*, those who have to leave school and enter on business pursuits at an early age are sufficiently grounded in a knowledge of figures to be able to work out all the ordinary questions which cross their path in commercial life ; *secondly*, that those who remain under instruction find very little difficulty in the after rules ; the *thought* which has been called forth by the First Part and the rapid manipulation acquired under this Second Part render all future exercises comparatively easy and pleasant.

It will be observed that in every Exercise more or less demand is made on knowledge already gained, so that no ground is lost and the learner does not, for each step forward, take two backward, as is too often the case where the rules of arithmetic are rigidly followed in consecutive order without constant repetition.

I have always found learners, however young or dull, greatly interested in the study of fractions, when once the subject has been properly explained and illustrated to them on the black board. I commence with the *line* which divides the numerator from the denominator, and explain that this is used when the quantity under consideration is divided into parts. Knowing that complex fractions as soon as they occur will present complex difficulty, I pave the way for its removal by impressing on the learner that in every fraction there is always a *main* line, and in some cases it has two others, one above and another below it ; but in all such cases the *main* line must be carefully

observed and continued throughout the operations. I then proceed to explain the meaning of the figure or figures under the line (denominator) by writing on the black board, say $\overline{8}, \overline{4}$; this is to show that something is divided into eight parts, and something else into four parts; call them two equal sized plumcakes, and ask if a piece of the first be given to the first boy and a piece of the second to the second boy, which will have the larger piece? The answer will show that the greater the number under the line the smaller the parts into which the thing is divided.

Now represent the quantity given to the two boys thus: $\frac{1}{8}, \frac{1}{4}$; then say, "I wish to give the third boy a piece equal to the difference between the first and second, and to the fourth boy a piece equal to the first and second added together." This will bring out the necessity for a common denominator and the rules for addition and subtraction.

Then follow such questions as, "I saw on a side-table $2\frac{2}{3}$ plumcakes; will any one explain or simplify this quantity?" *Answer*: "Three cakes, two whole ones and another cut into six pieces," &c. Thus the subject can be carried on with interest and profit.

I have mentioned common denominator and complex fractions. These must be gone over again and again until they are thoroughly mastered, if the pupil is to do his work intelligently.

With regard to the latter, I find it a good plan to smooth the way by giving out a goodly number of questions as follows: $\frac{2}{3}, \frac{2}{4}, \frac{2}{6}$

$\frac{4}{2}$. Call special attention to the *main* line, making it thicker than the others. Now simplify the first by connecting and multiplying the extremes for a new numerator, and the means for a new denominator; thus— $\frac{2}{3}) \frac{2}{4} = \frac{8}{9}$.

Take the second question, and show how the whole number over the main line can be made into a fraction by placing 1 as a denominator; then proceed as before, thus: $\frac{2}{3}) \frac{10}{4} = \frac{10}{4}$.

Third question: show how the whole number under the main line can be made into a fraction by placing 1 for a denominator; then proceed as before, thus: $\frac{4}{2}) \frac{4}{10} = \frac{4}{10}$.

Such questions are always very popular with a class of learners, and can be worked out with great rapidity.

Additional hints will follow as we proceed.

EXERCISE CI.

1. Find the G. C. M. of 7056, 11088, and L. C. M. of 21, 44, 132.
2. Reduce $\frac{3}{7}$, $\frac{2}{3}$, $\frac{4}{5}$, $\frac{5}{8}$, 2 to a common denominator; say which is greatest and which is the least.
3. Add together $\frac{1}{4}$, $\frac{3}{7}$, $\frac{5}{8}$, $\frac{1}{2}$, and bring $2\frac{1}{2}$, $3\frac{1}{4}$, $7\frac{1}{3}$ to improper fractions.
4. Take $\frac{1}{4}$ from $\frac{5}{8}$, and bring $2\frac{1}{4}$, $1\frac{1}{3}$, $3\frac{1}{2}$, $1\frac{1}{2}$ to mixed numbers.
5. Multiply £1 2s. 7d. by $914\frac{1}{2}$, and divide £609 15s. by $135\frac{1}{2}$.
6. If a man row at the rate of 7 miles an hour with the stream, the rate of which is 2 miles an hour, how fast will he row against it?

EXERCISE CII.

1. Find the G. C. M. of 2187, 8019, and the L. C. M. of 4, 6, 12, 18.
2. Reduce $\frac{501}{1837}$, $\frac{2108}{3813}$, $\frac{34261}{88113}$, $\frac{7410}{5770}$ to their lowest terms.
3. Add together $\frac{2}{3}$, $\frac{4}{5}$, $\frac{1}{4}$, $\frac{3}{7}$, and from $\frac{13}{8}$ subtract $\frac{1}{11}$ of $\frac{1}{2}$.
4. Find the sum and difference of $1\frac{1}{2}$ and $\frac{2}{3}$, and divide £601 14s. by $136\frac{1}{2}$.
5. Reduce to whole or mixed numbers $2\frac{2}{3}$, $1\frac{1}{2}$, $\frac{5}{8}$, $\frac{9}{5}$, and bring $7\frac{1}{2}$, $9\frac{1}{4}$, $2\frac{1}{8}$, 5, to improper fractions.
6. Make out a bill for the following articles, &c. : 57 feet of sashes, at $10\frac{1}{2}$ d. per foot; 560 feet of ash, at $3\frac{1}{2}$ d. per foot; 79 cubic feet of oak, at 4s. 2d. per cubic foot; 136 cubic feet of deal, at 3s. 9d. per cubic foot; 95 feet of oak, at 5s. 6d. per foot; 9 men's labour for 154 days, at 4s. 9d. each per day.

EXERCISE CIII.

1. Find the G. C. M. of ten thousand three hundred and ninety-five, and sixteen thousand eight hundred and nineteen. Also the L. C. M. of 32, 36, 42, 56, 63, 12, 9.

2. Reduce $\frac{348}{148}$, $\frac{340}{3000}$, $\frac{356}{1000}$, $\frac{3200}{3200}$, $\frac{370}{360}$ to their lowest terms.
3. $\frac{3}{4} + \frac{5}{8} + \frac{1}{11} + \frac{2}{9} + \frac{1}{5}$; and find the difference between $2\frac{1}{2}$ and $3\frac{1}{4}$.
4. Find the sum, difference, and product of $\frac{7}{13}$ and $\frac{2}{3}$.
5. If a ship cost £16425 15s., what is the value of $\frac{3}{100}$ ths?
6. If 1 yard cost 15s. 6 $\frac{1}{2}$ d. what will $32\frac{1}{2}$ yards cost? Divide £240 1s. 10 $\frac{1}{2}$ d. by 147 $\frac{3}{4}$.

EXERCISE CIV.

1. In 9503707 pints how many quarters, bushels, &c.; and in 120505 square feet how many acres, &c.?
2. A gentleman's income is £685, out of which he saves £274 7s. 6d.; what is his daily expenditure?
3. Multiply $\frac{7}{12}$ of $\frac{3}{4}$ by $\frac{2}{3}$ of $\frac{1}{3}$, and divide $\frac{3}{4}$ of $\frac{4}{5}$ by $\frac{2}{11}$.
4. Add together the difference, product, and quotient of $\frac{6}{16}$ and $\frac{4}{5}$ (divide the first by the last).
5. From 112 take $7\frac{5}{16}$ of $12\frac{3}{4}$ and simplify $(\frac{1}{3} + \frac{2}{3} + \frac{1}{4}) \div (\frac{2}{3} - \frac{1}{3})$.
6. How often will a coach wheel 7 ft. 9 $\frac{1}{2}$ in. in circumference turn in passing over a distance of $42\frac{1}{2}$ miles? and in what time will it perform the journey going at the rate of $8\frac{1}{2}$ miles an hour?

A multitude of errors occur through want of attention to the following simple rules. I therefore make no apology for bringing them under the special notice of young students, who are reminded that in multiplication of fractions, when all the numerators "cancel out," the *new numerator* is 1; when all the denominators cancel out, the *new denominator* is 1; and when all the numerators and denominators cancel out, the answer is $\frac{1}{1}$, or one whole number.

Examples.

$$\text{First case: } \frac{2}{4} \times \frac{2}{3} \text{ of } \frac{3}{4} = \frac{1}{2}$$

$$\text{Second case: } \frac{2}{3} \text{ of } \frac{2}{3} \times \frac{5}{12} = \frac{2}{3} = 2$$

$$\text{Third case: } \frac{2}{3} \times \frac{2}{3} \text{ of } \frac{3}{4} \text{ of } \frac{1}{2} = \frac{1}{1} = 1$$

Again, many errors occur from an inability to distinguish between factors and terms, it is therefore well to remember that only + and - separate terms; for instance, in the example

$$\frac{1}{3} + \frac{2}{4} - \frac{1}{2} \times \frac{7}{8} \text{ of } \frac{4}{5}$$

we have three terms $\frac{1}{3}$, $\frac{2}{4}$ and $\frac{1}{2} \times \frac{7}{8}$ of $\frac{4}{5}$; the first and second are simple, the third is compound and must be reduced to a simple fraction before the question can be worked out, thus :—

$$\frac{1}{2} \times \frac{7}{8} \times \frac{4}{5} = \frac{7}{20}$$

then restate the question,

$$\frac{1}{3} + \frac{2}{4} - \frac{7}{20} = 1\frac{1}{6}.$$

Parentheses form another sore subject to beginners; the following hints, therefore, may prove of service to such. First, let it be remembered that the quantity enclosed in a bracket must be worked out by itself, and the simple fraction thus obtained substituted for the bracketed fractions, thus :

$$\frac{2}{4} + \left(\frac{2}{3} - \frac{1}{4} + \frac{1}{5}\right).$$

The quantities within the bracket $\frac{2}{3} - \frac{1}{4} + \frac{1}{5} = \frac{19}{60}$.

Instead of the bracket $\frac{2}{4} + \frac{19}{60} = \frac{49}{30} = 1\frac{19}{30}$.

It will be seen that the bracket is preceded by +, in which case the bracket can be dispensed with, and the result is the same; but if the bracket be preceded by — the bracket can only be removed by changing all the signs within it, thus :

$$\begin{aligned} \frac{2}{4} - \left(\frac{2}{3} - \frac{1}{4} + \frac{1}{5}\right) &= \\ \frac{2}{4} - \frac{2}{3} + \frac{1}{4} - \frac{1}{5} &= \frac{9}{60}, \end{aligned}$$

so that when the question only involves addition and subtraction the brackets can be removed by attending to the signs, otherwise the bracketed quantities must be worked out apart, as directed above.

When a bracket is preceded by a quantity but no sign, then multiplication is intended, thus :

$$\frac{5}{6} \left(\frac{2}{3} - \frac{1}{4} + \frac{1}{5}\right).$$

The quantities within the bracket = $\frac{1}{3}\frac{2}{3}$, which has to be multiplied by $\frac{5}{8}$, thus :

$$\frac{5}{8} \times \frac{1}{3}\frac{2}{3} = \frac{5}{24}.$$

Sometimes two or three parentheses occur one within another, and I advise those who have not yet learnt a quicker method to simplify such questions by removing the inmost bracket first, restating the question with the new term thus obtained, and so on to the end, thus :

$$\frac{1}{2} \left[8\frac{1}{4} + \frac{2}{3} - \left\{ \frac{2}{3} + \frac{1}{4} + \left(\frac{2}{3} \text{ of } \frac{1}{4} \times \frac{4}{5} \right) - \frac{5}{8} + \frac{1}{6} \right\} - \frac{2}{3} + \frac{1}{2} \right].$$

The inmost parenthesis is $\left(\frac{2}{3} \text{ of } \frac{1}{4} \times \frac{4}{5} \right) = \frac{2}{15}$.

Restate the question :—

$$\frac{1}{2} \left\{ 8\frac{1}{4} + \frac{2}{3} - \left(\frac{2}{3} + \frac{1}{4} + \frac{2}{15} - \frac{5}{8} + \frac{1}{6} \right) - \frac{2}{3} + \frac{1}{2} \right\}.$$

The inmost parenthesis has only + and - signs within and preceded by -, so that it can be got rid of by changing the within signs, thus :

$$\frac{1}{2} \left(8\frac{1}{4} + \frac{2}{3} - \frac{2}{3} - \frac{1}{4} - \frac{2}{15} + \frac{5}{8} - \frac{1}{6} - \frac{2}{3} + \frac{1}{2} \right)$$

This parenthesis = $8\frac{1}{4}$.

Hence the final operation is $\frac{1}{2} \times 8\frac{1}{4} = 4\frac{1}{8}$.

EXERCISE CV.

1. Reduce $\frac{856}{938}$, $\frac{475}{1000}$, $\frac{35}{945}$ to their lowest terms.
2. Reduce $3\frac{10}{144}$, $8\frac{6}{23}$, $14\frac{15}{17}$, $5\frac{106}{11}$ to improper fractions, and $\frac{3109}{189}$, $\frac{13}{3}$, $\frac{42}{2}$, $\frac{271}{5}$ to mixed numbers.
3. Reduce $\frac{13}{25}$, $\frac{124}{125}$, $\frac{17}{26}$, $\frac{3}{100}$, to a common denominator, and find the cost of $3\frac{3}{4}$ pieces, each $25\frac{1}{2}$ yds. at 6s. 3d. per yard.
4. How many solid squares with 9 men on each side can be formed out of a million men ? Also, how many hollow squares ?
5. A shopkeeper bought four casks of sugar, each containing 3 cwt. 1 qr. 14 lbs. The first month he sold 1 cwt. 2 qrs. 25 lbs. ; the second 2 cwt. 0 qr. 19 lbs. ; the third 3 cwt. 1 qr. 26 lbs. ; the fourth 2 cwt. 1 qr. 14 lbs. ; the fifth 1 cwt. 0 qr. 10 lbs. How much had he taken out of the last cask ?
6. If I have $19\frac{1}{8}$ loaves to distribute to poor children, how many can I relieve by giving $\frac{1}{8}$ of a loaf to each ?

EXERCISE CVI.

1. $4\frac{1}{2}$ of $\frac{2}{3}$ of $3\frac{1}{2} \times \frac{7}{8}$; 6 of $\frac{1}{2}$ of $3\frac{1}{4}$ of $\frac{5}{8} \div 3\frac{1}{2}$.
2. Add together $\frac{3}{8}$ of $\frac{1}{2}$ of $\frac{5}{8}$ of 6; $1\frac{1}{2}$, $\frac{7}{8}$ of $\frac{3}{4}$ and $\frac{3}{8}$. Find the sum of $\frac{7}{8}$ of a guinea, $\frac{5}{8}$ of a £, and $\frac{3}{4}$ of a shilling.
3. Multiply 3 oz. 5 dwts. $5\frac{3}{4}$ grs. by 7; and 3 mls. 6 fur. $35\frac{1}{4}$ pls. by 35.
4. A person mixed 6 lbs. of tea at 3s. 6d., 10 lbs. at 3s. 5d., 8 lbs. at 4s. 1d., and 12 lbs. at 4s. 4d.; and sold the mixture at 4s. 9d. per lb.; what did he gain by the sale?
5. What is the sum of $10\frac{1}{2}$, $9\frac{3}{4}$, $12\frac{5}{8}$? also of $18\frac{9}{11}$, $56\frac{1}{13}$, $\frac{5}{8}$? also $85\frac{1}{8}$, $\frac{3}{4}$ of $\frac{1}{3}$, $9\frac{1}{2}$?
6. Make out a bill for $18\frac{1}{2}$ yards of silk at 7s. 6d. per yard, 21 yards of calico at $11\frac{1}{2}$ d. per yard, 2 doz. pairs of gloves at 2s. 9d. per pair, and 10 yards of ribbon at 1s. 11d. per yard.

EXERCISE CVII.

1. What is the sum of $\frac{1}{8}$ of a ton, $\frac{1}{16}$ of a cwt., $\frac{3}{8}$ of a qr., $\frac{2}{3}$ of $\frac{3}{4}$ of a lb.?
2. Add together $\frac{3}{4}$ of a lb., $\frac{3}{8}$ of an oz., and $\frac{5}{8}$ of a dwt.; also $\pounds 1\frac{1}{2}$ + $\pounds 1\frac{1}{2}$ s. + $\frac{3}{8}$ d.
3. Find the value of $\frac{5}{8}$ ths of 1s.; $\frac{7}{8}$ ths of £1; $\frac{1}{15}$ ths of 4s. 6d.; $\frac{2}{11}$ ths of 10s. 1d.
4. Reduce $\frac{232295}{24438}$ to its lowest terms; and $\frac{1}{7}$ of $2\frac{1}{3}$ of $6\frac{7}{8} \div 4\frac{2}{3}$ to a simple fraction, and multiply the result by $12\frac{3}{4}$.
5. Find the value of $132\frac{1}{2}$ articles at £7 15s. 6d. each; and find the number of threepences and farthings in 100 half-crowns.
6. Bring 5792685 inches to miles, &c.; and reduce 5 a. 2 rds. 11 pls. 7 yds. 5 ft. 29 in. to inches.

EXERCISE CVIII.

1. $\frac{3}{4} + \frac{1}{10} + \frac{1}{12} + \frac{1}{3} + \frac{1}{18}$; $1\frac{1}{2} - \frac{7}{12}$; $\frac{3}{4} \times \frac{7}{8} \times \frac{4}{5} \times \frac{3}{8} \times \frac{9}{10} \times \frac{7}{8}$.
2. Reduce to mixed numbers $\frac{1017}{14}$; $1\frac{252}{13}$; $1\frac{115}{18}$; $4\frac{1527}{16}$.

3. Bring to the least common denominator $\frac{1}{9}$, $\frac{2}{18}$, $\frac{3}{27}$, $\frac{4}{36}$, $\frac{5}{45}$; and find the G. C. M. of 2904, 3696, 9856.

4. Divide $\frac{7}{8} + (\frac{3}{4} \text{ of } \frac{1}{2})$ by $(\frac{2}{3} - \frac{1}{4})$; and find the L. C. M. of 7, 11, 21, 33, 42, 55.

5. Find the least sum of money that can be paid, with the same number of guineas, crowns, and half-crowns.

6. A purse containing £81 13s. 6d. made up of a certain number of sovereigns, twice as many half-sovereigns, three times as many half-crowns, and four times as many sixpences; required the number of half-sovereigns and sixpences.

EXERCISE CIX.

1. $\frac{2\frac{3}{4}}{5\frac{1}{2}}$ of $\frac{1}{8}$ of $\frac{3}{4} \times \frac{1}{3}$ of $\frac{4\frac{3}{8}}{7\frac{1}{2}} \times \frac{7\frac{3}{4}}{5\frac{1}{2}} \times \frac{11\frac{3}{8}}{29}$ of $\frac{4\frac{1}{8}}{13} \times \frac{3\frac{1}{4}}{10\frac{3}{8}}$ of $31\frac{1}{2}$ of $20\frac{3}{4}$.

2. $4\frac{3}{4} + \frac{3}{4}$ of $10\frac{1}{2} + 3\frac{3}{10} - 2\frac{1}{10}$; find the sum of $\frac{1}{4}$ of a mile, $\frac{1}{3}$ of a yard, and $\frac{1}{4}$ of a foot.

3. Add together $\frac{1}{4}$ of a week, $\frac{3}{4}$ of a day, and $\frac{1}{6}$ of an hour; and divide $4\frac{1}{2}$ by $2\frac{1}{4}$ of $1\frac{1}{2}$.

4. Find the difference between $\frac{1}{3}$ of $7\frac{1}{2}$ and $\frac{3}{8}$ of $1\frac{1}{4}$, and multiply the result by $3\frac{3}{4}$.

5. Find the sum and difference of £2 6s. 4 $\frac{1}{2}$ d. and £6 14s. 9 $\frac{1}{2}$ d.; also what number must be taken from $17\frac{9}{11}$ to leave $7\frac{1}{2}$?

6. Find the cost of 321 lbs. of tea, at 3s. 3 $\frac{1}{2}$ d. per lb.; if 21 lbs. be spoiled, at what price per lb. must the remainder be sold to realise a profit of £2?

EXERCISE CX.

1. Divide $17\frac{3}{8}$ by 8; and $654\frac{1}{2}$ by 9.

2. $\frac{3}{4} - \frac{1}{5} + \frac{1}{12} + \frac{1}{3} - \frac{1}{12} - \frac{1}{12} + \frac{1}{12} + \frac{1}{3} - \frac{3}{8}$.

3. Bring 2s. 6 $\frac{1}{2}$ d. to fraction of a £, and simplify $\frac{2\frac{1}{2} \text{ of } 3\frac{1}{2}}{7\frac{1}{4} \times 2}$ of $(8\frac{3}{8} - 1\frac{1}{4})$.

4. Add together £7 $\frac{1}{4}$, 6 $\frac{1}{4}$ of a guinea, 4 $\frac{3}{4}$ of a shilling, and 5 $\frac{1}{8}$ of a florin.

5. Multiply £86 4s. 6 $\frac{1}{2}$ d. by 7 $\frac{1}{2}$, and divide the product by 19 $\frac{3}{4}$.

6. Express 9s. 7 $\frac{1}{2}$ d. as the fraction of a guinea, and $\frac{5}{8}$ of a guinea as the fraction of a £.

To reduce quantities of one denomination to a vulgar or decimal fraction of another denomination is a very simple operation when performed according to the following directions. 1. The first operation is to set down the question in the form of a fraction; 2. Take care that the numerator is the quantity to be reduced to the fraction of the other; 3. Bring both numerator and denominator to the lowest denomination mentioned for a new numerator and new denominator, which will be the answer.

Examples.—Reduce 2 $\frac{1}{2}$ d. to the fraction of a guinea; find what decimal of 9s. is 7s. 4d.; and reduce $\frac{1}{2}$ in. to the fraction of 2 ft. 3 in.

$$(a) \quad \frac{2\frac{1}{2}\text{d.}}{21\text{s.}} = \frac{6}{504} = \frac{1}{84}$$

$$(b) \quad \frac{7\text{s. } 4\text{d.}}{9\text{s.}} = \frac{22}{27} = \cdot 81\bar{4}$$

$$(c) \quad \frac{\frac{1}{2}\text{ in.}}{2\text{ ft. } 3\text{ in.}} = \frac{1}{81}$$

(a) The lowest denomination mentioned is halfpence, to which both are reduced, and each retaining its position is brought to the lowest terms, $\frac{1}{84}$, the answer.

(b) Here fourpence is the lowest denomination mentioned to which both are brought, giving $\frac{22}{27}$, then being reduced to a decimal we have $\cdot 81\bar{4}$, the answer.

(c) One-third of an inch is the lowest to which both are reduced, which gives $\frac{1}{81}$, the answer.

EXERCISE CXI.

1. Reduce $\frac{3}{4}$ ths of a yard to the fraction of an ell (English), and 6 oz. 15 dwts. to the fraction of a lb.

2. Find the net weight of 4 bales of cotton, each weighing respectively 3 cwts. 1 qr. 23 lbs.; 4 cwts. 0 qr. 11 lbs.; 4 cwts. 2 qrs. 25 lbs.; 3 cwts. 2 qrs. 25 lbs., allowing 8 $\frac{1}{2}$ lbs. on each bale for ropes, 1 lb. for draft, and 4 $\frac{1}{2}$ lbs. per cwt. gross for tape.

3. A owned $\frac{3}{5}$ ths of a farm of 250 acres ; he sold $\frac{1}{3}$ rd of his share to B, and B sold $\frac{1}{3}$ rd of his share to C ; what was the value of C's land at £60 per acre.

4. Sugar is worth $\frac{7}{8}$ ths of £5 per cwt., and tea $3\frac{1}{2}$ d. per oz. ; what quantity of tea must be given in exchange for 1 ton 6 cwt. of sugar ?

5. Simplify $\frac{2\frac{1}{2}-1\frac{1}{4}}{8\frac{1}{8}\times 4\frac{1}{4}}$; $40\frac{2}{3} - (3\frac{2}{3} + 8\frac{1}{2} - 6\frac{1}{9}) \times 5\frac{1}{2}$; $3\frac{1}{3} + (8\frac{1}{4} \times 6\frac{2}{3} - 2\frac{1}{3}) \div (1\frac{1}{8} \times 7\frac{1}{3})$.

6. If it take $5\frac{1}{4}$ yds. of cloth for a great coat, 4 yds. for a dress coat, $2\frac{1}{2}$ yds. for a pair of trousers, $\frac{7}{8}$ yd. for a waistcoat, what will be the cost of the suit, at 15s. 6d. per yd., and the making £2 2s. 6d. ?

EXERCISE CXII.

$$1. \quad \frac{3 + \frac{2}{3}}{3 - \frac{2}{3}} \div \frac{2 - \frac{1}{6}}{2 + \frac{1}{6}} ; \frac{16\frac{2}{3}}{1\frac{1}{3} \text{ of } 6\frac{1}{4}} \times \frac{1\frac{1}{3} \times 6\frac{1}{4}}{16\frac{2}{3}} ; \frac{2\frac{1}{4} - \frac{1}{8}}{2\frac{1}{4} - 1\frac{1}{8}}$$

$$2. \quad \left(\frac{2\frac{3}{4} + 1\frac{1}{4}}{4\frac{1}{2} + 2\frac{1}{3}} + \frac{2\frac{3}{8}}{8\frac{1}{2}} \right) \div \frac{2\frac{1}{4} - \frac{3}{8} \times 1\frac{1}{2}}{\frac{2}{3} \text{ of } 2\frac{1}{4} + 1\frac{1}{2}} ; \frac{\frac{2}{3} + \frac{1}{2} - \frac{7}{8}}{6 \left(\frac{2}{3} \text{ of } \frac{1}{2} + \frac{1}{3} - \frac{1}{9} \right)}$$

3. What fraction must be added to the sum of $23\frac{15}{16}$, $6\frac{9}{11}$, and $\frac{4}{5}$ to make the total $33\frac{7}{5}$?

4. A purse and its contents are worth £1 6s. 8d. ; the contents are 7 times the value of the purse ; what is the amount ?

5. Add together $4\frac{3}{8}$ pounds, $6\frac{3}{8}$ shillings, and $9\frac{1}{5}$ pence ; reduce it to pence, and multiply by $21\frac{1}{6} \div 4\frac{1}{3}$.

6. A coach goes 8 miles an hour, the train 25 ; how much time will be saved by train in a journey of 120 miles ? and what will be the difference in the fare, the coach being $2\frac{3}{8}$ d., the train $1\frac{1}{4}$ d. per mile ?

EXERCISE CXIII.

1. Reduce 3 a. 2 rds. 36 pls. to square feet, and find the value of 38 square yards of carpet, at $9\frac{1}{2}$ d. per square foot.

2. Make out an invoice for the following articles : 16 pairs of socks, at 4s. 6d. per pair ; 9 pairs of worsted ditto, at 5s. 3d. per pair ; 8 pairs thread ditto, at 3s. 10d. per pair ; 12 pairs of silk ditto, at

15s. per pair ; 3 pairs of gloves, at 3s. 6d. per pair ; 8 pairs of cotton ditto, at 2s. 6d.

2. By what number should £27 17s. 10½d. be multiplied to make it £13500 11s. 6d. ?

4. What part of 3 a. 2 rds. is 32½ poles. Find the value of 42 pieces of cloth, each measuring 26 yds. 2 ft. 1 qr., at 12s. 6½d. per yard ?

5. Simplify $(3\frac{1}{3} + 1\frac{1}{2} + 4\frac{1}{8}) \div [\frac{1}{2} + \frac{1}{4} \text{ of } (\frac{1}{3} - \frac{1}{7})]$; $(4\frac{1}{8} + 2\frac{1}{2} + 4\frac{3}{8}) \times [(\frac{1}{2} + \frac{1}{3}) \text{ of } (\frac{1}{9} - \frac{1}{16})]$.

6. A can do a piece of work in 16 days, B in 20 days, C in 24 days, and D in 28 days ; in what time will they do it all working together ? In how much shorter time would A and B do it together than C and D ?

The key to such questions as the last in the above Exercise is to see that if a man can do a piece of work, say in ten days, he does $\frac{1}{10}$ a day, and if assisted by another who can do the same work in five days, you must add $\frac{1}{5}$ to $\frac{1}{10}$ as the amount done by the two working together.

Example.—A can do a piece of work in 10 days ; B in 5 days ; C in 15 days ; in what time will they do it all working together ?

$$\left. \begin{array}{l} A = \frac{1}{10} \text{ per day} \\ B = \frac{1}{5} \text{ } \\ C = \frac{1}{15} \text{ } \end{array} \right\} = \frac{6}{15} \text{ together.}$$

Now invert the fraction, and you have the answer.

$$\frac{15}{6} = 2\frac{1}{2} \text{ days.}$$

EXERCISE CXIV.

1. Simplify $\frac{3\frac{1}{4} - 2\frac{1}{2} + 6\frac{1}{2}}{7\frac{3}{4} - 1\frac{1}{2}\text{th} + 3\frac{1}{2}} \times 2\frac{1}{4} \text{ of } 7\frac{6}{11}\text{ths of } 2\frac{1}{3}\text{th.}$

2. Find the value of $\frac{3}{8}\text{ths}$ of a florin + $\frac{1}{12}\text{th}$ of a crown + $\frac{2}{15}\text{ths}$ of a pound - $\frac{3}{4}$ of a shilling + $\frac{1}{4}\text{ths}$ of a guinea.

3. $\frac{16\frac{2}{3}}{4\frac{1}{3}}$ of £1 ; 2 tons 16 cwts. 1 qr. 18 lbs. 12 oz. 10 drs. $\div 5\frac{1}{4}$.

4. A ship is worth £18000 ; what share will £850 purchase ? What is the value of $\frac{1}{3}\text{th}$ of $\frac{1}{3}\text{th}$ of her ?

5. Simplify $\left\{ \frac{3 + \frac{4}{5}}{3\frac{4}{5}} - \frac{2 - \frac{4}{5}}{2 + \frac{4}{5}} \right\} \div \frac{3 - \frac{2}{2\frac{1}{4}}}{4}$; multiply 3 a. 2 rds. 30 pls. 12 yds. by $27\frac{1}{2}$.
6. How often will a coach wheel 6 ft. $9\frac{1}{2}$ in. in circumference turn in passing over $56\frac{3}{4}$ miles?

EXERCISE CXV.

1. A bankrupt owes £1864 15s.; he can pay 6s. 4d. in the pound; how much will his creditors lose?
2. If a man row 5 miles an hour with the stream, the rate of which is $1\frac{1}{2}$ miles, how fast will he row against it?
3. A man leaves home with a sum of money in his pocket; he pays away $\frac{1}{4}$ th of it to the grocer, $\frac{1}{3}$ rd of the remainder to the baker, $\frac{1}{2}$ of what is left to the butcher; he then has £1 2s. 6d. in his purse. Required the amount he had at first.
4. Add together $\frac{3}{4}$ of 2 guineas, $\frac{2}{3}$ ths of 16s. 6d., $\frac{4}{5}$ ths of 6s. 10d., $\frac{2}{10}$ ths of 15s. 2d., and $\frac{7}{8}$ ths of 4s. 7d.
5. Simplify $\left(\frac{1}{3\frac{1}{2}} - \frac{2\frac{1}{2}}{9} + \frac{3\frac{1}{2}}{2} \right) \div (3\frac{2}{3} \times 2\frac{1}{3})$; $8 + \frac{1}{3 + \frac{1}{2 + \frac{1}{2}}}$.
6. I sold a boat to B for $\frac{1}{6}$ th more than it costs, B sells it to C for £10 4s. 2d., which was $\frac{1}{3}$ th less than he gave for it; what was the original cost?

EXERCISE CXVI.

1. Find the difference between a million and a half and sixty-nine thousand one hundred and nine.
2. In 1860 the total number of passengers conveyed by railway in the United Kingdom was 61876910, of which 5842315 were first-class passengers, and 19404262 second class; how many travelled by third class?
3. Find the value of $\frac{16\frac{2}{3}}{20\frac{1}{2}}$ of £2 1s. + $\frac{2}{3}$ ths of £206 4s. + $2\frac{1}{3}$ th of 17s. 9d.

4. Find the difference between

$$\frac{\frac{1}{3} - \frac{1}{4}}{\frac{1}{2} + 1\frac{1}{2}} + \frac{\frac{1}{3} - \frac{1}{4}}{1\frac{1}{2} + \frac{1}{2}} \text{ and } \frac{\frac{1}{3} - \frac{1}{6}}{\frac{1}{3} + \frac{1}{6}} + \frac{\frac{1}{4} - \frac{1}{6}}{\frac{1}{8} + 1\frac{1}{2}}.$$

5. Write down in the order of magnitude $\frac{7+8}{8+11}$, $\frac{7}{8}$, $\frac{1}{11}$; also find the difference between the sum of the first and second, and the second and third.

6. A gentleman bought an estate for £18764, and after laying out £2316 in improvements, sold two-thirds of it for £15013 $\frac{1}{3}$, at a profit of £24 per acre. How many acres did the estate contain? and what did it cost per acre?

EXERCISE CXVII.

1. The divisor is 325, the quotient 87432, and the remainder 27; required the dividend.
2. How many suits of clothes can be made out of 624 yds. 3 qrs. of cloth, supposing each coat requires $3\frac{1}{8}$ yards, each pair of trousers $2\frac{1}{2}$ yards, and each waistcoat $\frac{3}{4}$ of a yard?
3. What fraction of a guinea is equivalent to $\frac{3}{7}$ ths of $\frac{4}{5}$ ths of a sovereign?
4. From $2\frac{3}{4}$ of 11s. 8d. take $1\frac{1}{2}$ of 17s. $2\frac{1}{2}$ d., and reduce the remainder to the fraction of 13s. 5 $\frac{1}{2}$ d.
5. A train travels $109\frac{2}{3}$ miles in $4\frac{3}{4}$ hours; what is the rate per hour? Reduce $\frac{1}{2880}$ of a pound to the fraction of a farthing?
6. Simplify $\frac{5\frac{7}{8} \div 11\frac{3}{4} + 3}{5\frac{7}{8} \div 11\frac{3}{4} - \frac{1}{3}}$ of $1\frac{7}{8}$ ths of a guinea.

EXERCISE CXVIII.

1. A city containing 864752 inhabitants is divided into five parishes; the population of the first 76937, of the second 125342, of the third 154261; the other two have an equal number. Find the population of each of the two other parishes.
2. Make an invoice of the following articles: 14 $\frac{7}{8}$ yards of silk

at 16s. 8d. per yard ; $4\frac{1}{8}$ of lawn, at 5s. per yard ; $9\frac{1}{2}$ yards of cambric, at 5s. 2d. per yard ; 15 yds. 1 nl. of brocade, at 12s. per yard ; and 72 yards of tape, at 6 yards for 1d.

3. Two armies, numbering 20000, met in battle ; one was $\frac{3}{4}$ as many as the other ; four in every 25 of the larger died in the field, 25 per cent. died in hospital, and two out of every 20 died on the march home ; of the smaller army only 40 per cent. lived to reach home. Required, the original strength of each army and the numbers which perished.

4. A gentleman gave 16 tons $3\frac{3}{4}$ cwts. of coal to a number of poor persons, allowing $1\frac{1}{4}$ cwt. to each ; how many were there ?

5. If a bushel of wheat will sow an acre of land, what will it cost to sow $23\frac{3}{8}$ acres, the wheat being £3 5s. 6d. per quarter ?

6. What fraction of 6 mls. 2 fur. 7 pls. 11 yds. 1 ft. 6 ins. is $\frac{7}{15}$ ths of a league ?

EXERCISE CXIX.

1. Reduce 3 tons 9 cwts. 2 qrs. 4 lbs. 6 oz. to ounces ; and 13 mls. 5 fur. 9 pls. 3 yds. to inches.

2. Multiply £864 16s. $4\frac{1}{2}$ d. by $209\frac{1}{2}$, and divide the product by $39\frac{3}{8}$.

3. Find the L. C. M. of 15, 17, 34, 45, 3, 9, and reduce $\frac{1344}{112}$ to its lowest terms.

4. Find the value of $\frac{3}{4}$ of $\frac{7}{8}$ of £3 2s. 6d. $-\frac{6-2}{\frac{1}{2}}$ of 16s. 7d. $+\frac{3\frac{1}{2} + 2\frac{1}{2}}{\frac{6}{8}}$ of a guinea.

5. A cargo of wheat is worth £1520, the charge is £5 per cent. for insurance ; for what amount must I insure so as to cover the value of cargo and insurance ?

6. Add together $\frac{3}{4}$ of a square mile, $\frac{3}{4}$ of an acre, and 99 square yards, giving the answer in square feet.

EXERCISE CXX.

1. A has 148 apples, B has 68 more than A, and C has 32 more than B. A gives B and C each 38, B gives A and C each 68, and C

gives A and B each 20. How many apples has A, B, C, respectively after these exchanges?

2. Reduce £48 17s. 6 $\frac{3}{4}$ d. to sevenths of a penny.
3. Simplify $\left\{ \frac{1}{3} \text{ of } 2\frac{4}{7} \text{ of } 7\frac{2}{11} - \frac{3\frac{2}{3}}{1\frac{2}{3}} \right\} \div \frac{6\frac{2}{3} + 5\frac{2}{3}}{9\frac{2}{3} - 5\frac{2}{3}}$
4. Change .5, .75, .214, 8.4, 26.75, .005, to vulgar fractions or mixed numbers.
5. Change $\frac{5}{16}$, $\frac{1}{16}$, $\frac{1}{1600}$, $\frac{216}{1000}$, $37\frac{3}{10000}$, $8\frac{1}{1000}$ to decimals, and add them together.
6. Find the sum, difference, product, and quotient of 21.462 and 8.5.

EXERCISE CXXI.

1. Change the following fractions to decimals, and the decimals to fractions of equal value:

$$\frac{7}{8}, \frac{3}{8}, \frac{1}{2}, \frac{7}{10}, \frac{3}{4}, .6 \cdot 18 \cdot 134 \cdot 27 \cdot 856.$$

2. Multiply and divide by removing the decimal point 86.427 by 10; 68.495 by 100; 652.4673 by 1000; 3964.92 by 1000; also find their sum, and the difference between the first two and the last two.
3. Find the product and quotient of 178.031 and 2.03.
4. Find the value of $(\frac{3}{8} \text{ of } \frac{5}{8} + \frac{3}{4} \text{ of } \frac{1}{4})$ of a shilling.
5. Divide 67.814 by .000213 and by 213000.
6. Add together .130055, 900, 57.1, 13.34, .00000397, and subtract the result from 1314.9.

The position which division of decimals occupy in questions set for examination, proves that most students regard the subject as a difficult one. This need not be and will not be if they only attend to the following hints; in fact nothing is easier than to make it a question of simple division, by seeing that you have as many decimal places in the dividend as in the divisor, in which case divisor, dividend, and quotient may be treated as whole numbers.

If you have more decimals in the dividend than the divisor, then mark off in the quotient (from the *right hand*) the corresponding number, and the answer is obtained.

Examples :—Divide 314873·21 by ·47.

Here we have two decimal places in divisor and dividend ; we therefore get rid of them in each thus :

$$47 \overline{) 31487321} (669943 \text{ Ans.}$$

Divide 2617662 by 119·12. Here we have two decimals in the divisor and none in the dividend ; hence we must add two thus :

$$11912 \overline{) 261766200} (21975 \text{ Ans.}$$

Divide ·00046 by ·002. Here we have three in the divisor and five in the dividend ; we move the point in each case three places to the right, which leaves two decimals in the dividend, so that two will have to be marked off in the quotient thus :

$$002 \overline{) 00046} (23 \text{ Ans.}$$

Divide ·002 by ·0245. Here we have four decimals in the divisor and three in the dividend, so we must add one to the dividend thus :

$$0245 \overline{) 0020000000000} (08'155102040' \text{ Ans.}$$

To work out this question eleven decimals have been added (in addition to the one named above) ; hence we must mark off eleven in the quotient, which number is made up by a nought on the left hand.

EXERCISE CXXII.

1. If 20 men, 40 women, and 50 children receive £700 for 14 weeks' work, and 2 men receive as much as 3 women or 5 children, what sum can a woman earn a week ?
2. Reduce 150 lbs. 9 oz. 4 drs. 1 sc. 19 grs. to grains, and 5 a. 3 rds. 35 pls. 15 yds. 6 ft. 120 in. to inches.
3. Express as decimal fractions $5\frac{1}{2}$, $20\frac{3}{5}$, $9\frac{7}{10}$, $2\frac{1}{2}$, $10\frac{1}{4}$; also express as vulgar fractions ·12, ·4, ·15, ·9, ·6875.
4. If $\frac{2}{3}$ ths of a ship cost £1678, what is the worth of the whole ?
5. Find the sum and product of $\frac{7}{15}$, $\frac{4}{11}$, $\frac{3}{8}$, $\frac{1}{2}$, $12\frac{1}{2}$.
6. Multiply 84·316 by ·001, by ·01, by ·1, by 10, and by 100 ; also divide ·004 by ·00002.

EXERCISE CXXIII.

1. Find the L. C. M. of 8, 16, 20; also of 16, 14, 9, 12, 18.
2. Sixty pounds sterling may be distributed into three sums, so that $\frac{1}{3}$ rd of the first, $\frac{1}{4}$ th of the second, and $\frac{1}{5}$ th of the third, shall be equal amounts; what are the three sums?
3. Find $\frac{1}{25}$ th of £415 11s. 6 $\frac{1}{2}$ d., and $\frac{1}{9}$ th of 436 miles 6 fur. 4 yds.
4. What fraction of a cubic foot is $\frac{1}{12}$ ths of a cubic yard, and what fraction of an E. ell is $\frac{1}{3}$ ths of a F. ell?
5. Divide .001 by .0001, and 291 by .002, and 764.1 by 2.64.
6. Multiply £862 by 3.25, and divide 32 a. 2 rds. 30 pls. by 6.5.

EXERCISE CXXIV.

1. Make out a bill for the following articles:—3 quarters of wheat, at 7s. 9d. per bush.; 12 bush. of oats, at 3s. 2d. per bush.; 18 bush. of barley, at 4s. 10d. per bush.; 25 $\frac{1}{2}$ bush. of rye, at 4s. 4d. per bush.; 17 $\frac{1}{4}$ bush. of beans, at 4s. 10d. per bush.; 28 bush. of peas, at 4s. 8d. per bush.
2. A cask of sugar is sold at 6d. per lb., $\frac{1}{2}$ d. of which is profit; the amount realised is £100; find the weight of sugar, and the amount of profit.
3. Express as vulgar fractions of equal value .846, 34.85, 69.8406, .69, .815, 2.318.
4. Find .775, .6375, .125 of £1, and .75, .25, .925 of 1s.
5. Find the sum of $\frac{1}{6}$ of £1, $\frac{1}{5}$ of a guinea, $\frac{1}{6}$ of a crown, and 2 $\frac{1}{2}$ d.
6. A person having $\frac{1}{6}$ of a business; sells $\frac{1}{5}$ of his share for £1674; what is the whole business worth?

EXERCISE CXXV.

1. Subtract .474 from .892, and express the difference as a vulgar fraction.

2. Reduce 17 yds. 1 ft. 6 in. to the decimal of a mile, and 15s. 9½d. to the decimal of a £1.

3. Simplify $\frac{1}{2} \left(\frac{27 \times 21\frac{3}{4}}{48} \right) - \frac{2\cdot8541\bar{6}}{137}$.

4. If 3.5 yds. of cloth 1.75 yds. wide will make a suit of clothes, how much will be required if the cloth were only $\frac{3}{4}$ yds. wide?

5. What must be added to .0382 to make 3.8564? Divide 5.7648 by .68.

6. A lady's fortune, being £2100, was $\frac{4}{5}$ ths of $\frac{2}{3}$ ths of her brother's; how much was his?

EXERCISE CXXVI.

1. The minute hand of a clock moves 12 times as fast as the hour hand; at 12 o'clock the hands start from the same point; how far will they be asunder at 16 minutes past 12?

2. Divide 41.9717 by 34.12; and find how much a butcher gains who buys a bullock for £30, and sells 810 lbs. of beef, at 8d. per lb.?

3. Simplify $\frac{8\frac{1}{8}}{23\frac{1}{2}}$; $\frac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{\frac{1}{4} + \frac{1}{3} + \frac{1}{4}}$; $\frac{\frac{7}{8} \times 2\frac{3}{4} \times 2\frac{7}{8}}{1\frac{5}{8} \times 1\frac{7}{8} \times 8\frac{5}{8}}$.

4. Distribute £640 7s. 4d. among 3 persons, so that B shall have £95 13s. 7d. more than A, and £21 5s. 8d. less than C.

5. Find the value of .546190 of a guinea, and .82142157 of a cwt.

6. Divide £2171 5s. 7½d. by £56 10s. 10½d.

Questions similar to the first of the above Exercise are favourites with some examiners; students should therefore study them with care.

Examples.—It is now three o'clock; when will the hands of the clock be (a) together, (b) at right angles to each other, and (c) exactly opposite to each other? As the minute hand travels 12 times as fast as the hour hand, and gains 11 minutes in space out of every 12 over the hour hand, the question is, If in 12 m. it gains 11, in what time will it gain 15, or 30, or 45, &c.?

(a) The minute hand has to gain 15 m. space on the hour hand in order to be together.

$$\therefore \text{As } 11 : 15 :: 12 = 16\frac{4}{11} \text{ m. past three.}$$

(b) That they may be at right angles the minute hand has to gain 30 minutes space.

$$\therefore \text{As } 11 : 30 :: 12 = 32\frac{8}{11} \text{ m. past three.}$$

(c) To be opposite the gain must be 45 m.

$$\therefore \text{As } 11 : 45 :: 12 = 48\frac{2}{11} \text{ m. past three.}$$

NB. The first and third terms are always 11 and 12.

EXERCISE CXXVII.

1. If a farmer get 3 qrs. 6 bush. of wheat per acre off 98 acres, and sell it at £2 10s. 6d. a quarter, what is the amount?

2. Bring 5 a. 3 rds. 35 pls. 15 yds. 6 ft. 124 in., to inches; and 9864 in. to fur.

3. Reduce 4 guineas to the fraction of £4 10s. 6½d., 2½d. to the fraction of 1s., and find the value of 3.1496 of £6 13s. 6d., and .0928 of a day.

4. A, working alone, could mow a field in 7½ days, but with B's help in 4¼ days; in how many days would B do it alone?

5. In a subtraction sum the difference was ⅔ of the subtrahend, and the minuend was 8467.481; find the other two.

6. Reduce 3 pks. 1 gal. 3 qts. 1 pt. to the decimal of a bushel, and 3 qrs. 14 oz. to the decimal of a ton.

EXERCISE CXXVIII.

1. What fraction of a groat are ⅓th of a florin? and what fraction of a perch is ⅓th of an acre?

2. Find the value of $\frac{5\frac{1}{2} - 2\frac{1}{2}}{3\frac{3}{4} + \frac{9}{20}}$ of $\frac{4\frac{1}{2} + 5\frac{1}{2}}{4\frac{1}{20}}$, of $\frac{2\frac{3}{4} + 1\frac{3}{4}}{7\frac{1}{2} - 2\frac{1}{4}}$.

3. Divide .128 by .004, .016, .00256, and add the quotients together.

4. Add together $\cdot 5$ of a £, $\cdot 6$ of ten shillings, $23\cdot 75$ of a shilling and $649\frac{1}{2}$ d.
5. Find the difference between $\pounds 2\frac{1}{8}$ and $\pounds 3\cdot 125$; and reduce 17 yds. 1 ft. 9 in. to the decimal of a mile.
9. Bring $\cdot 00947\frac{3}{4}$ of a mile to inches, and multiply $\cdot 35$ by $\frac{7}{8} \div \frac{1}{3}$.

EXERCISE CXXIX.

1. Bought 126 yds. of cloth, at the rate of 15s. 6d. per yard, and had the whole made into coats, containing 2 yds. each; the trimmings cost $\pounds 5$ 15s., the making up $\pounds 23$ 2s. I then sold the coats at $\pounds 3$ 2s. 6d. each. How much did I gain by the transaction?
2. What may a person spend daily out of a yearly income of $\pounds 950$, so as to lay by $\pounds 384$ 5s.?
3. What is the worth of 19 bales of cotton, averaging 176 lbs. per bale, @ $5\cdot 75$ d. a pound, allowing 2 lbs. waste on each bale for package.
3. How many half-crowns in 68 guineas, $\pounds 68$, 68s., and 68d.? And how many labourers could be employed for a week with this money at $3\cdot 25$ s. each per day?
4. How many pieces weighing $11\frac{3}{4}$ lbs. can be cut out of $2\frac{3}{4}$ cwt. of beef? Find the value of a piece at $7\cdot 5$ d. per lb.
5. Divide $263\cdot 001$ by $\cdot 004$, $\cdot 4$, $\cdot 145$, $4\cdot 501$.
6. A and B together can do a piece of work in 5 days, but after working together 3 days B was compelled to leave; A then finished the job in 3 \cdot 5 days. How long would B. have been finishing the work, supposing he had been left alone, instead of A?

EXERCISE CXXX.

1. Divide 3 cwt. 2 qrs. 8 lbs. of sugar into parcels of 3 lbs., $2\frac{1}{2}$ lbs., $1\frac{3}{4}$ lbs., $1\frac{1}{2}$ lbs., $1\frac{1}{4}$ lbs., so as to have an equal number of parcels of each weight.
2. If $\frac{3}{4}$ of a million of shells are thrown at a besieged town at a cost of 15s. 9d. each, and fired with 6 lbs. of powder each, at 1s. 4d.

per lb., what is the cost of the cannonade, and how many poor families would it support for a year at 18s. each per week ?

3. A boy spent half his money in cakes, $\frac{1}{3}$ th in fruit, and the remainder in the purchase of a half-crown book, which, being soiled, he obtained at $\frac{2}{3}$ its original price ; what amount of pence had he at first ?

4. Add together $\frac{2}{3}$, $\frac{5}{8}$, $\frac{7}{8}$ and $\frac{4}{11}$; subtract the sum from $9\frac{1}{4} \times 3\frac{2}{3}$. Multiply the result by $\frac{5}{8}$ of $\frac{19\frac{1}{2}}{7\frac{3}{4}}$, and find what fraction the product is of $705\frac{3}{4}$.

5. Bought wine at 8s. 4d. per gal. ; some being lost by leakage, the remainder was sold at 2s. 6d. per quart, and the outlay exactly returned ; what portion was lost ?

6. If a sum of money be so divided that for every £5 received by A, B received £6, and for every £5 received by B, C gets £4 ; what is the sum divided, C's share being £103 3s. ?

THIRD PART.

WE now advance to the consideration of Proportion, Simple and Compound, at the same time keeping up the knowledge already gained, but so arranging the questions that gradual and solid progress is secured throughout.

A large number of the questions in Proportion have all money terms, because it is in stating such that most errors occur; also there are several relating to carpeting floors, papering and painting walls, inasmuch as in all examination papers one or more such questions are usually to be met with. Many students never attempt them, from a mistaken notion that a knowledge of mensuration is necessary to their solution, whereas they can be stated with as much certainty and worked out with the same ease as others of an ordinary character.

The student has only to adopt the following preliminary process in order to simplify and render his work very plain.

On reading the question let the terms be set down in the order they occur, one under the other, with the addition of a word or letter to indicate their nature, thus: "debt," "assets," "tax," "rent," "principal," "interest," "weight," "distance," "length," "breadth," &c. It will be found that two are alike, and the third one the same kind as the answer.

The stating, &c., follow, according to the regular rule.

Examples.—A tradesman fails for £2000, and his effects will only realise £1200; how much can he pay in the £?

£2000, debt.	—
£1200, effects.	—
£1, debt.	—

The first term mentioned in the question is £2000; put this down and give it its name, "debt." The next is £1200, the value of effects, which will produce so much cash, out of which the debts are to be paid as far as it will go. The last £1, "debt." Link together the like quantities, and note that the odd one is the same kind as the answer (so much in the £ is paid out of the effects); place the odd term in the third place, and as the answer must be less than this, put £1 in the second place and £2000 in the first, thus:

$$\begin{array}{ccc} \text{£} & \text{£} & \text{£} \\ \therefore \text{As } 2000 : 1 :: 1200 = 12\text{s. in the £.} \end{array}$$

A gentleman pays £43 15s. income-tax on an income of £1500; what amount will his neighbour have to pay whose income is £3250?

$$\begin{array}{r} \text{£43 15s., tax} \\ \text{£1500, income—} \\ \text{£3250, income—} \end{array}$$

$$\therefore \text{As } \begin{array}{ccc} \text{£} & \text{£} & \text{£ s. d.} \\ 1500 & : & 3250 :: 43 \text{ 15} = 94 \text{ 15 10.} \end{array}$$

If £10050 gain £351 15s., how much will £2000 gain in the same time?

$$\begin{array}{r} \text{£10050, principal—} \\ \text{£351 15s., interest} \\ \text{£2000, principal—} \end{array}$$

$$\therefore \text{As } \begin{array}{ccc} \text{£} & \text{£} & \text{£ s. d.} \\ 10050 & : & 2000 :: 351 \text{ 15} = 70 \end{array}$$

EXERCISE CXXXI.

1. How many $\frac{1}{2}$ d. buns can be purchased for £4 17s. 6 $\frac{1}{2}$ d.?
2. In counting my money in the dark, which I thought consisted entirely of gold and silver, it amounted to £4 17s. 4d., but I afterwards found that 4 pennies had been counted as half-crowns, and a half-sovereign for sixpence; what was the correct amount?
3. Find the sum of £18 4s. 4 $\frac{1}{2}$ d., £9 0s. 10 $\frac{1}{8}$ d., £3 15s. 7 $\frac{5}{8}$ d., £11 9s. 3 $\frac{1}{4}$ d., £8 13s. 6 $\frac{1}{4}$ d., and £27 17s. 7 $\frac{1}{8}$ d.
4. Express £874 13s. 4d. $\times 3.75$ as a decimal of £1000.
5. If 16 men can do a piece of work in 86 days, how long will it take 20 men and 9 boys, supposing one man to be equal to 3 boys?

6. If £56 15s. be paid as interest for the loan of £2600 for 6 months, how much should be charged for the loan of £824 for the same time?

EXERCISE CXXXII.

1. The Gregorian method of reckoning time omits a day in 133·333 years; we really ought to omit a day in 128·471 years; in what time will the error amount to a day?

2. How many allotments, each equal to 2 r. 7 per. 3 yds. 2 ft. 36 in., can be made out of 158 a. 20 p.

3. Multiply the square of 18·789 by 6·2832.

4. How many ducats at 4s. 11½d. each are equal in value to 3926 rix-dollars at 4s. 10d. each.

5. A draper having sold 129 yards of cloth at £1 2s. 6d. for 1½ yds. found that he had gained ten guineas; what did the cloth cost him?

6. What will the rates amount to on a house rented at £137 10s. when one rented at £156 15s. is rated at £35 7s. 6d.?

EXERCISE CXXXIII.

1. A post is divided into four parts; the first is ¾ths of the whole, the second is ⅔ds of the first, the third ⅞ths of the second, and the fourth is 2 yds. 1 ft. 4 in.; find the length of the post.

2. What fraction of a farthing is £100?

3. A person wishes to fill 2 casks of equal size with a gallon measure; into one he has to put a mixture of 1 gallon of water to 5 gallons of gin, and into the second 1 gallon of water to 9 gallons of gin; required the size of the smallest possible casks for this purpose.

4. If 26 English ells of satin cost £2 9s. 8d., what is the value of 18 yds. 1 qr.?

5. When the carriage of 4 cwt. 2 qrs. 14 lbs. for 25 miles is 17s. 3d. what weight can be carried the same distance for £2 16s. 4d.?

6. A train travelling 25 miles an hour leaves a certain station 1½ hours before another which travels at the rate of 35 miles an hour; how long before the second overtakes the first, and at what distance?

In the 5th question of the above exercise there would appear to be, at first sight, *four* terms, but on close inspection it will be seen that "25 miles" is cancelled by "same distance."

In the 2nd question of the next exercise reduce the days to hours ($6 \times 9 = 54$ hours).

EXERCISE CXXXIV.

1. A garrison of 1260 men has provisions for 37 days ; $\frac{1}{3}$ of the men being withdrawn after 15 days, how much longer will the provisions last ?

2. A number of men can reap 6 a. 2 r. in 6 days of 9 hours each ; in how many days of 10 hours each will the same men reap 23 a. 1 r. ?

3. If I pay away one-half of my money and 1s. more to A, one-half of the remainder and 1s. more to B, one-half of the remainder and 1s. more to C, and one-half of the remainder and 1s. more to D, I have 3s. 6d. left ; find how much I had at first.

4. If the length of a year be taken at $365\frac{1}{4}$ days instead of 365·242264 days, its true value, what will the error amount to in 200 years ?

5. What amount of income-tax would be payable on an income of £325 10s. at 7d. in the pound ?

6. If 12 men can execute a piece of work in $2\frac{1}{4}$ years, how long will 15 men take to do the same work ?

EXERCISE CXXXV.

1. Reduce $\frac{6}{2480}$ of a ton to the fraction of a quarter, and divide $\frac{2}{3}$ by $\frac{3}{8}$.

2. Three merchants freight a ship with 420 pipes of wine, of which 140 belong to A, 105 to B, and the rest to C ; during a storm they were obliged to throw 84 pipes overboard. What portion of the loss will each merchant sustain ?

3. Change $1\frac{2}{3}\frac{2}{5}\frac{1}{6}$ to a decimal.

4. A brother's and sister's fortune amounted to £2698, in the proportion of 7 to 5 ; how much did each receive ?

5. If a steam pump raise 3275 gallons of water in 6 hours, how long will it take to raise 1000 gallons?

6. The earth moves round the sun in $365\frac{1}{4}$ days; through how many degrees will it move in $121\frac{1}{2}$ days? (every circle is divided into 360 degrees).

EXERCISE CXXXVI.

1. The weights of two ovens are as 12 to 15; the smaller weighs 15 cwt. 3 qrs.; find the weight of the larger.

2. An investor gains £64 on £480, invested for 8 months; what would his profit have been on £600?

3. What quantity is obtained by adding $2\frac{1}{2}$ of $7\frac{1}{3}$ to $\frac{3\frac{1}{4} + \frac{1}{2}}{7\frac{1}{3}}$?

4. A certain factory employs an equal number of men, women, and children; their joint daily wages are £117 10s. Each man received 4s. 6d., each woman 3s. and each child 2s. 6d.; required the number of work-people.

5. From a given number I take away $\cdot 0125$ of the whole, and then $\cdot 125$ of what is left, and next $\cdot 25$ of the remainder; there is still left 16·59; what was the original number?

6. A piano left the maker's hand worth 60 guineas; in transferring it to the warehouse and storing it its value was depreciated $\frac{1}{10}$ th; the waggoner injured it to the value of £2 10s. in taking it to the railway-station; a collision on the railway did 4 times more damage to it than it had previously sustained, so that the consignee would not receive it unless all this was allowed for and $\frac{1}{3}$ taken off into the bargain. What did he pay for it?

EXERCISE CXXXVII.

1. An investor gains £64 on £480 invested for 8 months; what would his profit have been on £600 invested for 6 months?

2. If 427 persons received £521 3s. 6d. wages for 1 week, what will they receive for 57 weeks?

3. How many packages of 10 oz. each are there in 56 lbs. of Turkey rhubarb ?

4. How many gardens of 16 pls. 4 yds. each can be made from a field of 8 acres ?

6. A grocer has 1 cwt. of mixed coffee and chicory, mixed in proportion of 5 to 2, what quantity of chicory must be added so as to leave the proportion of 5 to 3 ?

The ratio of A to B is as 3 to 4 ; of B to C as 4 is to 5 ; of C to D as 5 is to 6 ; find the ratio between A, B, C, and D.

Compound Proportion :—The same method for arranging the terms in Simple Proportion should be carried out in Compound Proportion.

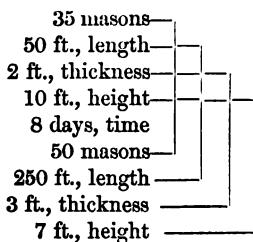
Example.—If £500 put out to interest gain £105 in 7 years, how much must be invested to produce £126 in 4 years ?

£500, principal	
£105, interest	}
7 years, time	
£126, interest	
4 years, time	

$$\begin{array}{rcl}
 \text{As } & \begin{array}{ccc} \pounds & \pounds & \pounds \\ 105 & : & 126 \\ 4 & : & 7 \end{array} & : : 500 \\
 & \hline
 & & 4 \\
 & 126 & 7 & 500 \\
 & \hline
 & 105 & 4 & = \text{Ans. } \pounds 882.
 \end{array}$$

The odd term is principal, the same kind as the answer, therefore put in the third place ; then take a pair of like terms, say interest, and with the third term ask the question, If £500 gain £105, would it take more or less to gain £126 ? More. Then put "more" (£126) in the second and £105 in the first. Proceed to the second pair of terms in the same way, and ask, If £500 gain so much in 7 years, would it take more or less to gain the same amount in 4 years ? More. Then put "more" (7) in the second place and 4 in the first. Then proceed according to ordinary rule.

If 35 masons build a wall 50 ft. long, 2 ft. thick, and 10 ft. high in 8 days, how long will it take 50 men to build a wall 250 ft. long, 3 ft. thick, and 7 ft. high ?



			days.
Men . . .	50	35	: : 8
Length . .	50	250	
Thickness .	2	3	
Height . .	10	7	

$$\begin{array}{r}
 \begin{array}{r}
 7 \quad 5 \quad 2 \\
 35 \quad 250 \quad 3 \quad 7 \quad 8 \\
 \hline
 50 \quad 50 \quad 2 \quad 10 \quad 2 \\
 10 \quad 2 \\
 5
 \end{array}
 = \frac{147}{5} = 29\frac{2}{5} \text{ dys.}
 \end{array}$$

The odd one is 8 days, put in the 3rd place, with which the question is asked with each set of like terms : If in 8 days 35 men do certain work, will 500 do it in more or less time ?

If in 8 days 50 feet of work is done, will 250 ft. take more or less time ? &c. According to the answer so the greater or less is put in the second place and the other in the first. All the first terms are combined for a divisor and the rest for a dividend ; the quotient is always the same denomination as the third term.

EXERCISE CXXXVIII.

1. Of what sum is £21 3s. 4d. five-sixths ?
2. A field measures 18 a. 2 rds. 25 p. ; a railway company take $\frac{2}{3}$ of it ; find the area of the remainder.

3. If 6·5 ounces of silver cost £1·95, what must be given for 3·75 lbs.?
4. From 14 cheeses weighing 3 qrs. $2\frac{1}{2}$ lbs. each, how many slices can be cut of 5 oz. 7 drs. each?
5. The ratio of A to B is as 3 to 4; of B to C as 4 to 5; of C to D as 5 to 6; find the ratio between A and D.
6. How much sugar worth £3 12s. 3d. per cwt. must be given in exchange for 12 tons 1 qr. 15 lbs. of a coarser kind at £27 10s. 4d. per ton?

EXERCISE CXXXIX.

1. Compare the ratio at which two men travel: one goes 3 miles an hour, the other 1 mile in 15 minutes.
- 2 Divide £34 4s. into two parts, so that the number of crowns in one may be equal to the number of shillings in the other.
3. A certain number of sovereigns, shillings, and sixpences together amount to £8 6s. 6d. and the amount of shillings is a guinea less than the sovereigns and $1\frac{1}{2}$ guineas more than the sixpences; find the number of each.
4. A chain cable measures 260 fathoms; the weight of a foot is 3 lbs.; find its total weight.
5. Bought goods valued £420 at six months' credit, paid down £120; when should the balance be paid?
6. If a merchant buy 19 pieces of silk, each $27\frac{1}{2}$ yds. at $3\frac{3}{4}$ s. per yard, what did the whole cost?

EXERCISE CXL.

1. Paper at $4\frac{1}{2}$ per quire, what must be given for $15\frac{3}{4}$ reams?
2. Bought 3·125 qrs. of cheese for £11·65; at what rate was that per cwt.?
3. If I change a £10 note, 4 sovereigns, 6 half, and for an equal number of florins, half-crowns, shillings, sixpences, fourpenny pieces, threepenny pieces, and pennies, how many of each of these coins shall I have?

4. A grocer gains on candles $1\frac{1}{4}$ d. in the shilling; the tallow chandler 4d. on a dozen pounds, at 8d. per lb.; and the butcher $2\frac{3}{4}$ d. on 2 lbs. of suet, at 6d. Compare the ratio of their respective profits.

5. Find the mean proportional between 9 and 16, also between $4\frac{1}{2}$ and $12\frac{1}{2}$.

6. A nine-foot length of cast-iron pipe weighs 4 cwt. 3 qrs. 17 lbs.; find the weight of a mile of pipe.

EXERCISE CXLI.

1. A gains $\frac{1}{2}$ d. in the shilling per day; B gains 4s. 6d. in the £ per week; and C 75 out of every £100 in 4 weeks. Compare their respective gains (leaving out Sundays).

2. Find a third proportional to 12 and 9, 16 and 8, 2 and 9, and a mean proportional to 12 and 3, 16 and 4, 2 and 40.

3. If 12 cows produce 240 lbs. of butter in 4 weeks, how many cows may be supposed to yield 20 lbs. in 1 week?

4. If 4000 acres be mown by 50 men in 20 days, how many men will mow 120 acres in 5 days?

5. If A and B enter business as partners, A putting in £450 and B £675, and they lose £350, how must the loss be divided between them?

6. How many hours per day must 14 labourers work to earn £18 4s. in 12 days, when the wages of 12 men for 15 days of 9 hours each amount to £20 5s.?

EXERCISE CXLII.

1. Reduce $2\frac{3}{8}$ of 4 gals. 1 pt. to decimal of 1 qr. 3 bush.

2. Find the area in miles, acres, &c., of $2\frac{1}{2}$ of $1\frac{1}{3}$ square miles.

3. A prize valued £3915 is taken by a ship's company and is to be divided among them in proportion to their pay and the length of time they have been in the ship. Required each man's share, supposing the captain shall have been on board 20 months, at £6 per month; 2 mates 15 months, at £3 10s. per month; 3 second mates 12 months, at £3 per month; and 157 sailors 27 months, at £2 10s. per month.

4. If 7 men can do a certain piece of work in 8 days, how long will it take 2 men and 7 boys to do a piece of work $2\frac{1}{2}$ times as large, calculating 3 men to be equal to 8 boys?

5. If £3 16s. 6d. pay for the carriage of 17 cwts. 60 miles, what weight can be carried 20 miles for 6s.?

6. A tradesman failed for £10000; his effects produced £6798 10s.; what did a creditor receive whose debt was £790 18s.?

EXERCISE CXLIII.

1. One miller mixed 14 lbs. of barley with 1 cwt. of wheat, another 135 lbs. of wheat with 15 lbs. of barley; compare the two quantities of barley in the two samples of flour.

2. A bankrupt's effects paid 7s. 9d. in the £, his debts amounting to £14980; what did his creditors get and lose?

3. If the breadth of a board be 8 in., how many feet will be required for a door 4 ft. by $6\frac{1}{2}$ ft?

4. If 64 yds. of carpet 3 qrs. wide cover a floor, how much cloth 5 qrs. wide will do it?

5. A wall 1239 yds. in length was to have been built by 60 men in 21 days, but at the end of 15 days, finding only 826 yards completed, how many more must be employed to finish it in the given time?

6. In Holland the cost of taking out a patent is,

for	5	years	£14
„	10	„	27
„	15	„	55.

Express these as ratios. Suppose a man took out a patent for 10 years instead of 15, and that the patent secured to him $2\frac{1}{2}$ d. per article, and 71364 were sold in the years between 10 and 15, what would he lose?

Carpeting floors and papering walls.—The same method as before is recommended for questions relating to measurement, taking care, when cost is required, first to ascertain the quantity, then the cost. To find the quantity of carpet (that is, the number of yards) to cover a floor three dimensions are always given, the length and breadth of the room, and width of the carpeting.

Example 1.—What will it cost to carpet a room 16 ft. 4 in. long by 10 ft. 6 in. broad, with carpet 27 in. wide, at 4s. 6d. per yard?

16 ft. 4 in., length
10 ft. 6 in., width—
27 in., width—

	in.	ft.	in.	ft.	in.
As	27	:	10	6	::: 16 4
			12		12
			<u>126</u>		<u>196</u>

$$\therefore \frac{14}{27} \times 196 = \frac{2744}{3} = 913\frac{2}{3} \text{ inches, same as third term.}$$

$913\frac{2}{3} \text{ in.} = 25 \text{ yds. } 1 \text{ ft. } 1\frac{2}{3} \text{ in., at 4s. 6d. per yard} = \text{£}5 \text{ 14s. } 2\frac{1}{2} \text{d.}$

Having arranged the terms one under the other as they occur in the question, I bracket together the *like* terms and proceed to state the sum. I find the odd term to be length, which is the same kind as the answer I desire to find (the cost I work out after finding the quantity, just as a draper would do: he measures the quantity, and multiplies it by the price per yard). I therefore put this in the third place; then ask, Will it take more or less carpet than 16 ft. 4 in.? More, because the carpet is not so wide as the room; therefore, I place the greater of the remaining terms in the second place, and the other in the first. The result is, $913\frac{2}{3}$ inches, the quantity required; this brought to yards and multiplied by 4s. 6d. = $\text{£}5 \text{ 14s. } 2\frac{1}{2} \text{d.}$

Example 2.—Find the length of a room which took 100 yards of 30 in. carpet to cover it, the room being 15 ft. 9 in. wide.

100 yds., length
30 in., width—
15 ft. 9 in., width—

	ft.	in.	yds.
As	15	9	: 30 ::: 100
		12	
		<u>189</u>	

$$\therefore \frac{20 \times 100}{63} = \frac{1000}{63} = 15\frac{55}{63} \text{ yards.}$$

Here the second term must be less than the first, because, the room being wider than the carpet, it will take more than one width; therefore, the room cannot measure as long as the carpet, but much less. Remember that the measurements dealt with in this way are always lineal, and therefore very simple.

If allowance is to be made for recesses, first deal with the room as above, then find the recesses in the same way, and add or subtract according to the question.

For papering walls the height of the room is always given, as well as the length and breadth; also the width of the paper, and the price when the cost is required.

Here, as before, first find the quantity, then the cost. We have seen how easy it is to deal with floors, and a little attention will prove that it is quite as easy to deal with walls.

Suppose you had to represent the four walls of a room with a piece of cardboard; you do so, and find the room when shaped to be 4 in. by 3 in., and 2 in. high; now open out the cardboard, place it flat on the table, and measure it as you would the floor, calling it 1 ft. 2 in. long, and 2 in. wide; the length is found by adding the length and breadth together and multiplying by 2, and the height is now called width. This is just what is done in measuring the walls of a room.

Example 1.—How many yards of paper 18 in. wide will hang the walls of a room 13 ft. 2 in. long, 10 ft. 4 in. wide, and 11 ft. 6 in. high?

		18 in., width—	
2 (13 ft. 2 in. + 10 ft. 4 in.) length			
		11 ft. 6 in., width—	
in.	ft. in.	{	
As 18 :	11 6 ::		
12			
138			
138			
		ft. in.	
		13 2	
		10 4	
		23 6	
		2	
		47 0	

4. If $\frac{1}{4}$ ths of a cwt. be worth £5 6s., what will be the price of $\frac{3}{4}$ ths of a ton?

5. If 9 iron bars 4 ft. long, 3 in. broad, and 2 in. thick, weigh 432 lbs., how much will 15 weigh, each $6\frac{1}{2}$ ft. long, 4 in. broad, and 3 in. thick?

6. If 75 men can do a piece of work in 5 days when the day is 12 hours long, in what time will 50 men do half as much work again, supposing they work 18 hours a day?

EXERCISE CXLV.

1. A square foot of iron plate weighs 9·37 lbs.; find the weight of a boiler which takes 276 square feet.

2. 10 lbs. is equivalent to ·089286 of what? and 4 in. is equivalent to $\frac{1}{3}$ of what?

3. A cubic foot of iron weighs 7700 ounces; find the weight of a plate 4 ft. 6 in. long, 2 ft. 4 in. wide, and $\frac{3}{8}$ ths of an inch thick.

4. If a 6d. loaf weighs 36 oz. when wheat is 50s. per qr., what is the price of wheat when the 7d. loaf weighs 35 oz.?

5. In chalk, 28 grs. of lime are found combined with 22 grs. of carbonic acid. But lime is also a compound containing 20 grs. of calcium to 8 grs. of oxygen; also carbonic acid consists of carbon and oxygen in the proportion of 6 and 16. Find the weight of oxygen in 12 lbs. of chalk.

6. If 12 men can dig a trench 40 yds. long, 5 feet wide, in 9 days of 8 hours each, how many hours a day must 56 men work in order to dig a trench of the same depth 220 yds. long and 6 ft. wide in 18 days?

EXERCISE CXLVI.

1. 19 cwt. 3 qrs. 7 lbs. of coal are delivered for office use on Monday evening, October 12th; there is one fire which is replenished 7 times a day, 3 lbs. 4 oz. being used each time; by what date will the coal be consumed, and how much is left for the last day?

2. A labourer dug up an equal number of ancient gold, silver, and

copper coins ; each gold coin was worth 22s. 6d., each silver one 3s. 9d., and each copper one 1d. ; the value of the whole was £67 3s. ; how many were there of each sort ?

3. Sugar at $3\frac{1}{2}$ d. per lb., what cost 10 cwts. 2 qrs. 16 lbs. ?

4. Five hogsheads of sugar, each weighing 7 cwts. 3 qrs. 27 lbs., at £3 10 10 $\frac{1}{2}$ per cwt.

5. If 47 men can build a house in 130 days of 8 hours each, how many hours a day must 196 men work to build a similar house in 26 days ?

6. If 17 men can dig a trench 15 yds. long and 4 broad in 3 days of 12 hours each, in how many days of 9 hours each can 8 men dig a trench 22 yds. long and 8 broad ?

EXERCISE CXLVII.

1. A kettle is placed on the fire holding 1 gallon of water, or 277·274 cubic inches ; if 1·27 of an oz. be converted into steam per minute, how long before all the water boils away ? (A cubic foot of water weighs 1000 oz.)

2. An inkstand holds $\frac{1}{4}$ pint of ink ; each time a pen is dipped into it there is taken up ·001 part of a gill ; how many dips will take it all up ?

3. If 16 acres of grass, averaging $2\frac{1}{4}$ tons per acre, be mown by 5 men in 4 days of 10 hours each, how many days will it take 4 men to mow 12 acres averaging $2\frac{7}{8}$ tons per acre, working 9 hours a day ?

4. How many yards of paper 27 ins. wide will hang a room 50 ft round and 9 ft. high ?

5. What must be the breadth of a courtyard which is 50 yds. long, to be equal in area to another 125 yds. long by 20 yds. broad ?

6. If 36 men earn £48 in 9 days, how much will 12 men earn in 90 days ?

EXERCISE CXLVIII.

1. In walking 20 miles, how many times does a walking-stick touch the ground, supposing it to do so at every third step, and each step to be 2 ft. 8 in. ?

2. Divide '001 by 6, and bring 11s. 10½d. to the decimal of a £.
3. Divide $17\frac{9}{16}$ miles by $\frac{4}{5}$ of 3; and take $\frac{5}{7}$ of $\frac{2}{3}$ of £5 from 108 half-crowns.
4. Divide 5s. 3d. into 4 shares in the proportion of 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$.
5. If two engines, each of 15-horse power, can pump 4300 gallons of water from a mine 75 fathoms deep in 15 minutes, what horse-power will be required to raise 4000 gallons from a depth of 90 fathoms in 20 minutes?
6. If a tax on an income of £1132 amount to £123 16s. 3d., what is that in the £?

EXERCISE CXLIX.

1. Divide 91 square miles by 27.
2. Ten feet of hoop iron weigh '685 lbs.; how many yards weigh a ton?
3. A workman is engaged for 28 days at 2s. 6d. per day; but instead of receiving anything, he is to pay 1s. per day on all days on which he is idle; he receives altogether £2 12s. 6d.; for how many idle days does he pay?
4. A certain work was completed by 3 men for £8 12s. 6d.; one man worked 150 hours, a second 120 hours, and a third 30 hours; how much should each receive?
5. A bankrupt owes one man £600, and another £800 10s.; his effects are worth £384 10s.; how much should each creditor receive?
6. If £3680 gain £180 in 9 months. how much must be invested to gain ten guineas in four months?

EXERCISE CL.

1. Make an invoice of the following articles: 27½ yards of silk, at 4s. 6½d. per yard; 123·75 yards of Irish linen, at 1s. 1½d. per yard; 89½ yards of black satin, at 5s. 2½d. per yard; 156½ yards of ribbon, at 2d. per 3 yards; packing case, 1s. 2d.; carriage paid on 4s. 6d.
2. How often will a cart-wheel turn in going a distance of 25 miles if its circumference is 3 ft. 10 in.?

3. The debts of a bankrupt amount to £977, and his assets to £420 6s. 3½d. ; how much can he pay in the £ ?

4. How many yards of cloth, worth 15s. 6d. per yard, must be given in exchange for 215 yards, worth 11s. 3d. per yard ?

5. If 4 men can reap 6·5 acres in 4·7 days of 10·5 hours each, in how many days will 10 men reap 26·25 acres, working 11·75 hrs. a day ?

6. If, when wheat is 6¼s. per bush., the sixpenny loaf weighs 5¼ lbs., what will 56¼ lbs. cost when wheat is 8¾s. per bush. ?

EXERCISE CLI.

1. A wheel makes 714 revolutions in passing over 1 mile 7 fur. ; what is its circumference ?

2 Twenty-nine purses contain each £18 4s. 9d. ; find the value of the whole, and write in words the number of fourpenny-pieces contained in the amount.

3. What will a creditor lose on a debt of £2645 15s. if he receive three dividends, of 3·75s., 2·5s. and 4s. 7½d. in the £ ?

4. What quantity of carpet, 27 in. wide, will cover a room 12 ft. by 9 ft. ? Ascertain the cost, at 4s. 6d. per yd.

5. If a train travel ⅔ths of a mile for a minute, how long will it take to travel ⅔rds of ⅓⅔ths of 118·75 miles ?

6. A lent B £1000 for 7 months when the rate of interest was 5 per cent. ; for how long a time must B lend A £500 to requite the kindness, interest being 4½ per cent. ?

EXERCISE CLII.

1. If A can do a piece of work in 6 days which takes B 8½ days to finish, in what time could it be done if both worked together ?

2. A cistern can be filled by one pipe in 1 hr. 50 m., and emptied by another in 2·25 hrs. ; how long would it take to fill the cistern, both pipes open at the same time ?

3. How much carpet, ¾ yd. wide, would be required for a room 16¼ ft. long and 12¾ ft. wide ? and what would it cost at 3s. per yd. ?

4. If a gentleman has to pay £17 0s. 1d. income-tax at 7d. in the £; what is his annual income?

5. A man and his son engage to do a certain work for 12 guineas; united, their earnings were 9s. per day; after 14 days the father is taken ill; in what time will the son finish the work by himself, supposing the father works half as fast again as the son?

6. A, B, and C met; A has 9 lbs. of beef, and B 12 lbs., and C 2s. 4d.; they divide the beef equally between them, and C divides his money between A and B in proportion to the quantity of beef he had received from each; required each man's share of beef and money.

EXERCISE CLIII.

1. Find the L. C. M. of nine digits.

2. How much wine at 36s. per dozen must be given in exchange for 76 cwts. 2 qrs. of coffee, worth £3 15s. 6d. per cwt.?

3. What would be the yearly premium on an assurance of £6250, at £4 2s. 5d. per £100?

4. Reduce $\frac{3}{4}$ ths of 15s. 2½d. to the decimal of a guinea.

5. Find the cost of carpeting a room 17·5 ft. by 14·75 ft., the carpet being 27 inches wide, at 3s. 9d. per yard.

6. If 16 men can do a piece of work in 11 days, how many men can do six times the quantity of work in $\frac{1}{10}$ th the time?

EXERCISE CLIV.

1. A schooner shipped for Dublin the following goods; find the total weight: 175 tons 8 cwts. 3 qrs. of corn; 98 tons 17 cwts. 2 qrs. of sugar; 4 tons 25 lbs. of cheese; 17 bales, each weighing 4 cwts. 3 qrs. 5 lbs. of cotton goods, and 300 tons 18 cwts. of coals.

2. A silver article, weighing 1 lb. 4 oz. 10 dwt., and worth £4 2s. 6d., is sent to a silversmith, who remelts it and mixes with it an alloy worth 1s. per oz. He returns the same weight, but its value is reduced to $\frac{1}{10}$ its former value; find how much alloy was employed.

3. If I gain a profit of $1\frac{1}{2}$ d. in selling a 6d. packet of tea weighing $3\frac{1}{2}$ oz., what weight must I sell in order to gain £38 15s. $7\frac{1}{2}$ d.?

4. A man saves out of his wages 3s. 6d. every week ; how long will he be saving £100?

5. If a family of 13 persons consume 3 qrs. 10 lbs. of butcher's meat a week, how long would 2 sheep, weighing each 1 cwt. 1 qr., supply 23 persons at the same rate of consumption?

6. Suppose the family mentioned in the last question paid their baker £3 10s. a month for bread, what difference would the removal of two of them make in their weekly bread bill?

EXERCISE CLV.

1. A train travelled 175 m. 3 fur. 16 pls., a horse 27 m. 2 fur. 17 pls., and a man 21 m. 12 pls.; find how much farther the train travelled than the horse, and the horse than the man.

2. Make out an invoice for the following articles, which Mr. J. W. Brown bought of Thomas Jones : 10 silver table-spoons, weighing $26\frac{1}{2}$ oz. at 7s. 3d. per oz.; 6 small table-spoons, weighing $14\frac{3}{4}$ oz. at 7s. 1d. per oz.; 12 teaspoons, weighing $13\frac{1}{2}$ oz. at 6s. 10d. per oz.; 24 silver forks, weighing 38 oz. at 7s. 9d. per oz.; pair of nutcrackers, weighing $6\frac{1}{2}$ oz. at 6s. 2d. per oz.; 8 salt-spoons, weighing 7 oz. at 6s. 3d. per oz.

3. If £825 15s. 9d. put out at interest gain £26 10s. in 12 months, what amount must be invested to gain £132 10s. in the same time?

4. If 12 ounces of silver be worth £3 12s. 6d., what is the value of 26 bars, each weighing 13 lbs. 10 oz. 12 dwts.?

5. If 26 men pave a street 560 yards long and 21 yards wide in 90 days, how many extra men would be required to pave another street 1235 yards long and 20 yards wide in half the time?

6. A builder engaged to erect 6 houses in 12 months, and placed 72 men in the works, but after 3 months it was discovered that only 4 houses would be required; how many men was he enabled to withdraw so that the other houses might be completed at the time first agreed on?

EXERCISE CLVI.

1. A man purchased 9 tons 3 cwts. of oats, and sent it away to his stores in seven carts. How much was in each, supposing each had an equal load?

2. Make out an invoice for the following articles: $17\frac{1}{2}$ reams of post, at 8s. 3d. per ream; 2000 envelopes, at 1s. 2d. per 100; $5\frac{1}{4}$ reams of note paper, at 4s. 6d. per ream; 8 volumes of ancient history, at 2s. $7\frac{1}{2}$ d. per volume; Hale's works, 19 volumes, at 1s. $9\frac{1}{2}$ d. per volume; 3000 circulars, at 30s. per 1000; packing-case, 1s. 6d.; carriage 3s. 9d.

3. A merchant's debts amount to £10864; he can only pay 6s. 9d. in the £; what do his creditors get and lose?

4. If 8 men can reap 7 acres in 5 days, how many men can reap 28 acres in the same time?

5. If 2 qrs. $6\frac{1}{2}$ lbs. cost $\frac{2}{3}$ of $\frac{1}{5}$ of £63 16s., how much will $\frac{1}{3}$ of $4\frac{1}{2}$ of 12 cwts. 1 qr. 11 lbs. cost?

6. Divide $94\cdot14$ by 9, $2\cdot3$, 1·5, and 14·001.

EXERCISE CLVII.

1. A boy is 12 years 8 months 1 week old; his younger brother 5 years 9 months 2 weeks old. How old was the former at the birth of the latter?

2. How many acres are equivalent to three million square miles? What number of halfpence are equivalent to 480gs. 14s. $6\frac{1}{2}$ d.?

3. A and B travel 120 miles together by rail; B, intending to return, takes a return ticket, for which he pays half as much again as A; they find that B travels cheaper than A by 4s. 2d. for 100 miles. Find the price of A's ticket.

4. Bought 18 articles for £64 6s., and afterwards sold them at the rate of £11 5s. 6d. for three. Did I gain or lose? and how much, (1) on each article, (2) on the lot?

5. The expense of maintaining a boarding-school consisting of 75 pupils is 1575 guineas per annum; how much would it cost to carry on a home for 80 poor boys for 6·75 years, at $\frac{2}{3}$ the cost each, compared with the boarding-school?

6. What fraction of a sovereign is $6\frac{5}{11} - 7\frac{1}{4} + 8\frac{11}{13} - \frac{81\frac{6}{13}}{91\frac{6}{13}}$ of three-pence?

EXERCISE CLVIII.

1. If 12 silver spoons weigh 8 oz. 14 dwts., what is the weight of each? Divide '0001 by 25, 2·5, '25.

2. Reduce to its simplest form

$$\frac{2\frac{1}{2} \text{ of } 4\frac{1}{7}}{3\frac{1}{3} \times \frac{1}{1\frac{1}{9}}} \text{ of } 1\frac{5}{29} \div \frac{1}{9}.$$

3. How many yards of matting $1\frac{1}{4}$ yd. wide will cover a room 20 ft. 9 in. long and 16 ft. 3 in. broad?

4. If the tax upon £656 10s. is £9 11s. 5 $\frac{1}{2}$ d., what is that in the £?

5. 14 persons in an excursion for 4 days spend in railway fare £89 6s.; cab hire, £5 2s. 6d.; hotel bills, £45 18s. 6d. How much would it cost 6 persons for a three-weeks' holiday at the same rate?

6. Suppose 35 masons to build a wall 364 ft. long $1\frac{1}{2}$ ft. thick and 16 ft. high in a fortnight; how long would it take 12 men to build another wall 62 ft. long, $13\frac{1}{2}$ in. thick, and $8\frac{1}{2}$ ft. high?

EXERCISE CLIX.

1. Divide $1\frac{3}{4}$ ounces senna into 5 doses, and bring 64·32046 to an improper fraction.

2. A has 20 gallons of wine, mixed in the proportion of 2 to 3; what quantity of the first must be added to make the proportion 3 to 4?

3. Find the value of '3 of a sovereign, '25 of a guinea, '16 of a half-crown, and 2·5 of a $\frac{1}{4}$ d.

4. If $\frac{2}{11}$ of $\frac{4}{5}$ of a ton of coal cost 5·75s., what will 6 loads cost, each weighing 1 ton 2 cwt. 1 qr.?

5. How many yards of paper, 18 inches wide, will hang the walls of a room 14 ft. by 11 ft., and 10 ft. high?

6. What will it cost to carpet the room mentioned in the last question with carpet 27 inches wide, at 4s. 6d. per yard?

EXERCISE CLX.

1. How many yards of paper 16 inches wide, and how many yards of carpet 27 inches wide, will be required for a room 16 ft. long, 12 ft. 6 in. wide, and 11 ft. high?

2. What will it cost to paper the walls of a room with paper 18 inches wide at 1d. per yard, the walls being 58 ft. round and 12 ft. high?

3. What will it cost to carpet a room 18 ft. 9 in. long by 14 ft. 3 in. wide with carpet 30 in. wide at 5s. 3d. per yard, making an allowance for a recess 3 ft. by $2\frac{1}{2}$ ft., to be carpeted the same as the rest of the floor?

4. How much paper 20 in. wide will be required for the walls of a room 17 ft. 6 in. long, 13 ft. 9 in. wide, 12 ft. 3 in. high? There are three windows, measuring 9 ft. by 3 ft. each, and a door 8 ft. by 4 ft.?

5. What would it cost to paper the walls and ceiling of a room with paper 22 in. wide, at $1\frac{1}{2}$ d. per yard? of a room 18 ft. 3 in. long, 17 ft. wide, and 11 ft. 9 in. high?

6. What would it cost to carpet a show-room 36.5 ft. sq. with carpet 27 in. wide at 5s. 8d. per yard, allowing for two counters, one being 20 ft. by 3 ft., the other 15 ft. by 2 ft. 6 in.?

FOURTH PART.

THE additional rules which come under examination in this part are, Practice, Square and Cube Root. These call for no special remark, except the formula for extracting the Cube Root, which is very liable to be forgotten. I have, therefore, invented the following device, which will be found to be very efficacious in aiding the memory.

Example.—Find the cube root of 12812904.

$$\begin{array}{r}
 12812904(234 \text{ Ans.} \\
 8 \\
 \hline
 4812
 \end{array}$$

2 ²	300		=	1200
2	30	3	=	180
		3 ²	=	9

$$\begin{array}{r}
 1389 \\
 \hline
 = 4167 \\
 \hline
 645904
 \end{array}$$

23 ²	300		=	158700
23	30	4	=	2760
		4 ²	=	16

$$\begin{array}{r}
 161476 \\
 \hline
 = \underline{\underline{645904}}
 \end{array}$$

After pointing off the periods and finding the nearest root of the first, I have 2 in the quotient, and 4812 as dividend for the next stage. Now comes in my little device in the shape of nine squares ruled on the left-hand side of the sum. Supposing it will go three times, I place 3 in the quotient, and fill up the device thus: begin with the last figure in the quotient, which is 3, and place it in the last space, *squared*, repeat it in the space over (not squared), then place the remaining portion of the quotient, which is 2, in the first space, *squared*, repeat it in the space under (not squared), then add 300 in the second space, and 30 in the space under. Multiply the sum of the products by the last figure in the quotient (3), which = 4167; subtract this from the 4812, take down the next period, and proceed as before. Place 4 in the quotient, also in the last space *squared*, repeated in the space over (not squared), place the rest of the quotient (23) in the first space *squared*, repeated in the space under (not squared), place 300 in the second space and 30 under; multiply the sum of the products, and subtract.

After using the squares a few times the formula will be so imprinted on the memory as to render its further use unnecessary.

EXERCISE CLXI.

1. A horse travels eight days, at the rate of 17 m. 2 fur. 15 p. per day; how far does he go?
2. Two ships were wrecked; from one 75 were saved, from the other 420; find the number of passengers and crew, when the number lost from one ship was double the number saved from the other.
3. If 3·5 lbs. of beef are worth 2s. 3½d. what would be the value of 3 bullocks, each weighing 5 cwt. 3 qrs. 1 lb.
4. Find the square of 391,247·25, $\frac{1}{2}$, and the square root of 68121.
5. Cube 27, 34·5, $\frac{1}{3}$, and find the cube root of 13824.
6. Find by practice—
 - a. 7642, at 2¼d., 3½d., 5¼d.
 - b. 6473, at 2s. 3d., 1s. 5d., 4s. 6d.
 - c. 2348, at £1 2s. 6d., £2 1s. 3d., £1 15s. 6d.

EXERCISE CLXII.

1. A farm measures 150 a. 3 rds. 17 pls.; nine fields are transferred to another tenant; each field on an average measures 3 a. 3 rds. 1 pl.; find how much is left.

2. A, B, and C can do a piece of work in 3, 4, 5 days respectively; in what time would they do it together? and what proportion of the work would be each man's share?

3. Divide $64\cdot006$ by 406 , $4\cdot06$, $\cdot406$, $40\cdot6$.

4. What fraction of a five pound note is a florin, 3s. $9\frac{1}{4}$ d., £2 6s., 72·5 farthings?

5. Find the square root of 764896 and the cube root of 1779581.

6. Find by practice—

a. 2478 at $4\frac{1}{2}$ d., $5\frac{1}{4}$ d., $6\frac{3}{4}$ d.

b. 6910 at 1s. 9d., 1s. $4\frac{1}{2}$ d., 2s. 5d.

c. 2054 at £1 1s. 2d., £1 4s. 8d., £2 5s. 9d.

EXERCISE CLXIII.

1. From 17 c. yds. 9 c. ft. take 8 c. yds. 12 c. ft. 100 c. in.

2. A pond is 3 acres in area, and has 6 in. of ice on it. If frozen water is 896 oz. avoirdupois to the cubic foot, find the quantity of ice in the pond.

3. Find the cost of carpeting a room 18·25 feet square, with carpet 30 in. wide, at 4s. 8d. per yard.

4. If the carriage of two tons for 18 miles cost 14s. 9d., what will 15 cwts. 1 qr. 14 lbs. cost for being carried 216·5 miles?

5. Square $864\cdot73$; $\cdot6$, $\frac{1}{3}$, and find the sq. root of $81\cdot576$.

6. Danish cubic foot is ·978 of an English and ·979 of an Austrian; find the length of an Austrian cubic foot in terms English cubic feet.

EXERCISE CLXIV.

1. A cub. ft. of ash weighs 760 oz.; find the weight of a piece of timber 50 ft. long, 2 ft. 4 in. wide, and 2 ft. 3 in. thick.

2. A boy selling oranges sells half his stock and 1 more to A, half of what remains and 2 more to B, and 3 that now remain to C; how many had he at first?

3. Reduce 12s. 4d., 13s. $6\frac{1}{2}$ d., 15s. $2\frac{3}{4}$ d. to the fraction of a florin and the decimal of a pound.

4. A square field measures 3 a.; find the length of one hedge.

5. Cube $84\cdot21$; $8\cdot421$; $\cdot8421$, and find the cube root of 2460375.

6. Find by practice—

a. 6508 at $2\frac{3}{4}$ d., $4\frac{1}{2}$ d., $7\frac{1}{4}$ d.

b. 8649 at 6s. 4d., 7s. $6\frac{1}{4}$ d., 8s. 2d.

c. 2476 at £2 2s. 1d., £2 3s. 4d., £2 5s. 9d.

EXERCISE CLXV.

1. Required the net weight of 30 barrels, each weighing 2 cwts. 3 qrs. 21 lbs., allowing $5\frac{3}{4}$ lbs. per barrel for tare.

2. If a family of 9 persons consume £1 10s. 6d. worth of butcher's meat a week when it is $6\frac{1}{2}$ d. per lb., how much more will they have to pay per week when it is $7\frac{3}{4}$ d. per lb.?

3. 24 houses are built on the four sides of a square; if the houses on one side cost £5100, what was the cost of one house?

4. If £13 6s. be the wages of 16 men for 4·5 days, what will be the wages of 30 men and 30 boys for 6·25 days, each boy being equal to $\frac{2}{3}$ of a man?

5. Find the square root of 622521·25 to 4 places of decimals, and the cube root of 1815848.

6. Find by practice—

a. 6214 at $5\frac{3}{4}$ d., $9\frac{1}{2}$ d., $11\frac{1}{4}$ d.

b. 4126 at 3s. $9\frac{1}{4}$ d., 4s. $7\frac{1}{2}$ d., 5s. $6\frac{3}{4}$ d.

c. 9068 at £3 2s. 2d., £3 3s. 7d., £3 4s. 3d.

EXERCISE CLXVI.

1. I multiplied a number by 5 instead of 6; my answer ought to have been $8640743\frac{1}{6}$; what was the number, and what was my answer?

2. Simplify $(4\frac{1}{2} + \frac{5}{12} + \frac{1}{4}) \div (4 - \frac{1}{4} \text{ of } \frac{1}{2} \text{ of } \frac{5}{12})$.
3. If an exhibition costing £500 and visited by 5000 persons produce a profit of £80 $\frac{2}{3}$, what would be the profit of one costing £200 more, attended by $\frac{2}{3}$ more people, at $\frac{1}{3}$ higher prices?
4. Find the side of a square, the area of which is 39601 square feet, and find the area of a square field, one side of which is 10 pls. $2\frac{1}{2}$ yds. long.
5. Find the cube root of 117649, and the solid contents of a block of marble the side of which measures 2 ft. 9 in.
6. Find by practice—
 6496 at $7\frac{1}{2}$ d., $11\frac{1}{4}$ d., $10\frac{3}{4}$ d.
 9652 at 1s. $3\frac{1}{4}$ d., 2s. $7\frac{1}{2}$ d., 5s. $4\frac{3}{4}$ d.
 3791 at £4 6s. 8d., £5 2s. 6d., £6 3s. 4d.

EXERCISE CLXVII.

1. A bankrupt has £250 in cash, £500 book debts, which are expected to realise 15s. in the £, and stock valued at £1050; he owes £5420; what will his creditors receive in the £?
2. Subtract $\cdot 746\bar{7}4$ from $\cdot 942\bar{6}$ and express the answer as a vulgar fraction.
3. A square is being laid out with ten houses on each side; an area of 64516 square feet in the centre is to be enclosed by iron railings at 2s. 6d. per foot (lineal); what will be the cost, and the proportion for each house?
4. How many miles could a person travel per train for a £5 note at $1\frac{1}{2}$ d. per mile?
5. If two men travel on an average 25 miles a day (Sundays excepted) for 40 weeks in the year, what would be the difference in 20 years, if one travelled first class at $2\frac{1}{2}$ d. and the other third class at $1\frac{1}{4}$ d. per mile?
6. Find by practice—
 6040 at $5\frac{1}{2}$ d., $7\frac{1}{2}$ d., $9\frac{3}{4}$ d.
 9251 at 6s. $7\frac{1}{2}$ d., 5s. $6\frac{3}{4}$ d., 7s. $2\frac{1}{4}$ d.
 8920 at £2 1s. 8d., £4 17s. 6d., £8 19s. 6d.

EXERCISE CLXVIII.

1. If the rates of a parish amount to £375 10s. 5d. per year and the rateable property be valued at £12875, how much is this in the £?

2. If £5420, lent out at interest, gain £220, what sum must be invested to gain £150 in half the time?

3. Simplify $\frac{3\frac{1}{2} \times 2\frac{1}{2}}{1\frac{1}{2} - 1\frac{2}{3}} \div \frac{\frac{2}{3} \div \frac{2}{3}}{\frac{3}{8}}$ and divide .01 by .0006.

4. Find the area of a square sheet of water, each side measuring 2 fur. 30 pls.

5. Find the square root of 603729, and the cube root of 7189057.

6. Find by practice—

3984 at $11\frac{1}{4}$ d., $8\frac{1}{2}$ d., $7\frac{3}{4}$ d.

2763 at 5s. $3\frac{3}{4}$ d., 9s. $2\frac{1}{4}$ d., 8s. $9\frac{3}{4}$ d.

3904 at £6 14s. $2\frac{1}{2}$ d., £2 1s. $7\frac{1}{4}$ d., £1 9s. $9\frac{1}{4}$ d.

EXERCISE CLXIX.

1. How often can 365 be taken from 40150? and what sum must be added to £3147 18s. $6\frac{1}{2}$ d. to make it exactly divisible by 365?

2. If 3 a. 2 rds. 12 pls. grow 15 qrs. 3 bush. 2 pks. of wheat, what should be the produce of 7 a. 3 rds. 36 pls.?

3. A grocer buys $6\frac{1}{2}$ cwt. of tea, at the rate of 17 guineas per cwt. He sells 3 cwt. of it at 2s. 9d. per lb., and the rest at 3s. $9\frac{3}{4}$ d. per lb.; how much is his gain?

4. Reduce $\frac{2}{3}$ of a square yard to the fraction of an acre, and £1 14s. $9\frac{3}{4}$ d. to the decimal of 2 guineas.

5. Find the square root of 207936, and the cube root of 27270901.

6. Find by practice—

9654 at $7\frac{1}{2}$ d., $8\frac{1}{4}$ d., $9\frac{3}{4}$ d.

6548 at 1s. $3\frac{1}{2}$ d., 2s. $7\frac{1}{4}$ d., 7s. $9\frac{1}{2}$ d.

8456 at £10 15s. 10d., £3 17s. 8d., £2 18s. 7d.

EXERCISE CLXX.

1. The produce of a field of wheat yielding 4 qrs. per acre is worth £148, when wheat is at £3 per qr. ; what will the produce of the same field be worth when the yield is 5 qrs. per acre and wheat is 50s. per qr. ?

2. If £7 are the wages of 4 men for $6\frac{1}{2}$ days, what are the wages of 12 men and 10 boys for 4 weeks, at $5\frac{1}{3}$ days in each week and 2 boys equal to one man.

3. Bought 3 cwts. of sugar, at 36s. 6d. per cwt., and retaining some for private use, sold the rest at $4\frac{1}{2}$ d. per lb., realising as much as the sugar cost ; how much was reserved for private use ?

4. Reduce to its simplest form $\frac{\frac{3}{8}-\frac{1}{2}}{\frac{8}{8}-\frac{3}{8}} \div \frac{1\frac{5}{8}-\frac{1}{8}}{\frac{1}{3}-\frac{1}{11}} + \frac{2\frac{1}{4}}{\frac{3}{8} \div \frac{1}{3\frac{1}{2}}}$.

5. Square 906090, cube $2\frac{1}{2}$, and find the square root of 213444.

6. Find by practice—

(a) 9861 at $3\frac{3}{4}$ d., $7\frac{1}{4}$ d., $11\frac{1}{2}$ d.

(b) 1689 at 12s. $2\frac{1}{4}$ d., 13s. 4d., 16s. $7\frac{3}{4}$ d.

(c) 2374 at £7 3s. 9d., £8 4s. 6d., £12 9s. 4d.

EXERCISE CLXXI.

1. If 25 gross of pens are bought at 1s. 10d. per gross, and sold at 1s. 6d. per hundred, what profit is made ?

2. Gas is charged at the rate of 4s. 3d. per thousand feet ; a warehouse consumes 3500 feet in the first quarter, 1500 feet the second quarter, 4500 in the third, and 2500 in the fourth ; what is the average cost per quarter ?

3. A bankrupt's effects are worth £8500, which will pay 7s. 4d. in the £ ; what is the amount of his debts ?

4. If 56 colliers employed in a pit get out 815 tons of coal in 9 days, what time would 18 colliers take to send up £100 worth of coal, supposing it to be worth 6s. 6d. per ton ?

5. Find the square root of 603729 and the cube root of 354.

6. Find by practice—

6704½ at £1 3s. 6d., £5 9s. 4½d., £6 2s. 6½d.

2490¼ at £4 7s. 6½d., 8s. 9¼d., £11 2s. 9d.

5713⅔ at 11¼d., 1s. 3¼d., 7s. 11½d.

EXERCISE CLXXII.

1. A watch and chain are worth together £14 6s.; the watch being worth £8 16s. more than the chain; find the worth of each.

2. If the fourpenny loaf weigh 2 lbs. 13 oz. when wheat is worth 6s. 3d. per bushel, how much ought the sixpenny loaf to weigh when wheat is 7s. 9d. per bushel?

3. If a million bricks, 9 in. long, 4½ in. wide, and 4 in. thick, be used in the erection of 4 houses, how many would be required 10½ in. long, 5½ in. wide and 5 in. thick?

4. In selling 18½ tons of iron at the rate of 1½s. per ⅓ of a ton I lost £5·6; required, the original cost per pound.

5. Find the sum of ·275 of a £., ·468 of a florin, ·6 of a shilling, and express the answer as a fraction of £1 3s. 4½d.

6. Find by practice—

6042⅓ at 4½d., 5¼d., 7½d.

2406⅔ at 3s. 7½d., 4s. 2¼d., 15s. 1¼d.

9127½ at £6 0s. 9d., £4 3s. 0¼d. £10 9s. 7½d.

EXERCISE CLXXIII.

1. Find the difference between $\frac{·23 \text{ of } 6·3}{76}$ and $\frac{203·6}{112½}$

2. How often does a man raise his right foot in walking four miles, supposing he takes 20 inches at each step?

3. If a merchant buy a cargo of coals weighing 120 tons, at 16s. 6d. per ton, and pay £5 for discharging the vessel, £2 2s. 6d. for storage, retaining 5 tons for home use, and sell the remainder at 23s. per ton, how much does he gain or lose?

4. How many yards of cloth, at 15s. 6d. per yard, ought I to receive in exchange for 2 tons of sugar, at 28s. per cwt. ?

5. If a cask of spirit containing 36 gallons is worth £28 8s., how much water must be added to reduce the value to 10s. 6d. per gallon ?

6. Find by practice—

5094 $\frac{7}{8}$ at $7\frac{1}{4}$ d., $9\frac{1}{2}$ d., $11\frac{3}{4}$ d.

4956 $\frac{3}{4}$ at 5s. $2\frac{1}{4}$ d., 6s. $4\frac{1}{2}$ d., 11s. $9\frac{3}{4}$ d.

5991 $\frac{1}{2}$ at £6 3s. 1d., £5 11s. 8d., £7 16s. $4\frac{3}{4}$ d.

EXERCISE CLXXIV.

1. The inhabitants of the world number 1215000000 ; express this number in words. There are said to be two hundred and twelve millions eight hundred and five thousand idolators in the world ; express this number in figures.

2. If I paid 141 boys 2s. 4d. each, and 27 women 15s. 8d. each, how many women would the same amount pay at 11s. 9d. each ?

3. What would it cost to carpet a room 20 ft. 3 in. by 17 ft. 9 in. with carpet 28 in. wide, at 4s. 10d. per yard ?

4. Find the length of $\frac{004671 \times 60 \cdot 4}{0351}$ of a mile.

5. Twenty workmen make 480 pairs of shoes in four weeks, working 8 hours a day, how many days would it take 24 workmen to make a thousand pairs, working 10 hrs. a day ?

6. Find by practice—

2745 at $4\frac{1}{2}$ d., $9\frac{1}{2}$ d., $11\frac{3}{4}$ d.

5427 at 3s. $5\frac{1}{2}$ d., 11s. $4\frac{3}{4}$ d., 15s. $2\frac{1}{8}$ d.

2791 at £4 0s. $6\frac{1}{2}$ d., £5 15s. $0\frac{1}{2}$ d., £8 2s. $11\frac{3}{4}$ d.

EXERCISE CLXXV.

1. An army, extending two miles in length, leaves at 6 A.M. in order to encamp on a plain 25 miles distant ; they travel 3 miles an hour, but rest $1\frac{1}{2}$ hours on the road for refreshments. At what time will the last man reach the place of destination ?

2. What will it cost to plant one side of a square field whose area is 4 acres with shrubs 6 feet apart, at 1s. each ?

3. Find the solid contents of a cubical block of granite, each side being 37 inches. Find the cube root of $42\frac{1}{2}$.

4. A train travelling 25 miles an hour leaves London at 8 A.M. for a place 250 miles distant; another train leaves at 10 A.M.; at what rate must this one travel in order to pass the first one at a station ten miles this side the place of its destination ?

5. What will it cost to paper the walls of a room measuring 16 ft. 4 in. long, 12 ft. 6 in. wide, and 10 ft. 10 in. high, with paper 30 inches wide, at 2d. per yard ?

6. Find by practice—

12914 at $2\frac{1}{8}$ d., $4\frac{1}{4}$ d., $9\frac{1}{4}$ d.

41921 $\frac{1}{4}$ at 3s. $2\frac{1}{2}$ d., 5s. $7\frac{1}{4}$ d., 10s. $8\frac{1}{2}$ d.

60101 $\frac{1}{2}$ at £6 3s. 4d., £8 17s. 9d., £16 9s. 2d.

EXERCISE CLXXVI.

1. In a workshop where men, women, and children are employed, and of each an equal number, the weekly wages amount to £56 5s.; each man receives 3s. 6d., each woman 2s. 6d., and each child 1s. 6d., per day; required the number of workpeople.

2. If the rent of a farm containing 256 a. 2 rds. 30 pls. be £126 10s. per annum, what would be the rent of another containing 372 a. 1 rd. 25 pls., supposing 5 acres of the first to be worth 7 acres of the second ?

3. Four women can do as much as 7 boys, and 9 men can do as much as 7 women; how long will it take a woman and boy working together to finish a piece of work which a man will do in 11 days ?

4. Bring $\frac{1}{4}$ inch, 1 ft. 3 in., 2.75 ft., to the fraction of a square yard.

5. Find the square root of $\frac{9}{2}$, and the cube root of $12\frac{1}{2}$.

6. Find by practice—

21410 at $3\frac{1}{4}$ d., $6\frac{1}{2}$ d., $7\frac{1}{4}$ d.

14512 at 4s. $7\frac{1}{2}$ d., 5s. $2\frac{1}{2}$ d., 9s. $6\frac{1}{2}$ d.

5634 at £7 19s. 9d., £18 0s. 11d., £4 13s. $7\frac{1}{2}$ d.

EXERCISE CLXXVII.

1. How often is 2 fur. 18 pls. contained in 10 m. 5 fur. 30 pls.?
2. A can walk 10 miles in $2\frac{1}{2}$ hours, B can walk 11 miles in $2\frac{1}{2}$ hours; they start together at 7.30 A.M. for a journey of 52 miles. At what time will they respectively finish their journey? and, when the first arrives, how far behind will the second be?
3. A can do a piece of work in 8 days, B in 9 days, and C in 10 days; in what time can they do it all three working together?
4. Find the square root of $\frac{1}{2}$ of $5\frac{1}{2}$, and the cube root of $1\frac{1}{2}$ of $5\frac{1}{2}$.
5. A merchant mixes 120 gallons of wine, at 12s. 3d. per gallon, with 98 gallons at 17s. 6d. per gallon, and sells the mixture at 15s. 3d. per gallon; what profit does he make?
6. Find by practice—

2163 $\frac{3}{4}$ at $2\frac{1}{2}$ d., $7\frac{1}{4}$ d., $10\frac{3}{4}$ d.

36120 $\frac{1}{8}$ at 3s. $11\frac{1}{4}$ d., 4s. $7\frac{1}{2}$ d., 8s. $6\frac{3}{4}$ d.

29114 $\frac{3}{8}$ at £11 2s. 4d., £9 11s. 7d., £6 19s. 9d.

EXERCISE CLXXVIII.

1. If to dig a trench 23 ft. 3 in. long, 3 ft. 2 in. wide, and 5 ft. 7 in. deep, cost £1 5s., how much will it cost to dig another, 30 ft. 4 in. long, 2 ft. 9 in. wide, and 6 ft. 4 in. deep?
2. What is the circumference of a coach-wheel which revolves 9900 times in travelling 15 miles?
3. Divide 256·03 by 74·1, and ·00045 by ·03.
4. Find the value of £·003645, and find the area of a square field the side of which measures ·45 poles.
5. If £163·75 be paid as interest at the rate of £3 per cent. for the loan of £8050 for a certain time, what amount will realise £200 for the same time when the interest is £5 per cent.?
6. Find by practice—

86009 at $6\frac{2}{11}$ d., $10\frac{2}{3}$ d., $11\frac{1}{15}$ d.

90068 at 7s. $11\frac{1}{3}$ d., 9s. $9\frac{2}{3}$ d., 16s. $4\frac{1}{2}$ d.

68009 at £4 1s. $8\frac{1}{2}$ d., £11 5s. $2\frac{2}{3}$ d., £18 15s. $1\frac{1}{2}$ d.

EXERCISE CLXXIX.

1. What will it cost to carpet a room 19 ft. 3 in. long, 13 ft. 5 in. wide, at 5s. 4d. per square yard? (a border round the room one foot wide is to be left uncovered.) If the carpet were 2 ft. 6 in. wide, and the price 4s. 5½d., what would it cost?

2. Find the value of 234 shillings, and express 3½ inches as the fraction of a mile.

3. Find the square root of $\frac{625}{11881}$, and the cube root of $1953\frac{1}{8}$.

4. An embankment 3240 yards long must be completed in 50 working days; 106 men are at first employed, and at the end of 20 days it is found that only 810 yards are completed. How many more men must be put on the work so as to finish it in the given time?

5. Multiply $23\frac{1}{4}$ ths of a ton by $\frac{2}{3}$ rds of $\frac{2}{3}$ ths of $\frac{1}{6}$ th, and divide .0001 by 9.0003.

6. Find by practice $90014\frac{3}{8}$ at $3\frac{1}{2}$ d., $4\frac{1}{2}$ d., $7\frac{3}{4}$ d.

" " $410009\frac{1}{8}$ at $15\frac{1}{2}$ d., 7s. $2\frac{1}{2}$ d., 9s. $5\frac{1}{2}$ d.

" " $5600\frac{7}{8}$ at £14 0s. $6\frac{1}{2}$ d., £18 2s. $6\frac{1}{4}$, and
£9 14s. $9\frac{3}{4}$ d.

EXERCISE CLXXX.

1. Find the cost of papering the walls of a room 19 ft. 3 in. long, 13 ft. 6 in. wide, and 11 ft. high, with paper 32 in. wide, at $2\frac{1}{2}$ d. per yard. The door measures 9 ft. by 3 ft., and two windows 10 ft. by 5 ft. each.

2. What amount of tax must be paid on an income of £867 10s. at $7\frac{1}{2}$ d. in the £?

3. What amount must be added to £926 14s. $2\frac{1}{2}$ d., so that it may be exactly divisible by 106?

4. Reduce £3 17s. 2d. to the fraction of a farthing, and find the value of .003261 of a £.

5. What quantity of cloth at 13s. $4\frac{1}{2}$ d. must be given in exchange for three other pieces, each measuring 36 yds. 1 qr. 2 nls., at 10s. 9d. per yard?

6. Find by practice $3014\frac{1}{8}$ at $7\frac{1}{4}$ d., $9\frac{1}{2}$ d., $11\frac{3}{4}$ d.
 " " $4103\frac{2}{11}$ at 3s. $9\frac{1}{4}$ d., 4s. $6\frac{1}{2}$ d., 7s. $8\frac{3}{4}$ d.
 " " $80406\frac{1}{11}$ at £5 6s. $4\frac{3}{4}$ d., £7 8s. $1\frac{1}{2}$ d.,
 £12 13s. $11\frac{1}{4}$ d.

EXERCISE CLXXXI.

1. A bankrupt's stock is worth £3026; his book debts £10421 15s., policy of assurance £500, furniture £320 10s. He owes his creditors £36894. How much will one receive whose account is £365 17s. 6d.?
2. One cwt. of potatoes would last one family one week, another family nine days, and another a fortnight; how long would the three families together take to consume them?
3. A railway company charges 7s. per cwt. for 240 miles; how much will the carriage of 6 tons 3 cwt. 1 qr. be for 105 miles?
4. Take the square of 27364 from the square of 285, and divide the remainder by '0071.
5. Find the value of '00021 guineas, and bring it to the fraction of a crown.
6. Find by practice the cost of 3 qrs. 16 lbs. of sugar, at 28s. 3d per cwt.

EXERCISE CLXXXII.

1. £100 is to be distributed among an equal number of poor men women, boys, and girls; each man is to have 5s. 6d. each, woman 4s. 6d. each, child 2s. 6d.; how many persons can be relieved?
2. One man can do a piece of work in 6 days, another can do three times as much in 14 days, and a third half as much in 2 days; in what time would they do the work, all working together?
3. The estimated value of the ratable property of a parish is £56246; a rate of £351 10s. 9d. is required; what is that in the £?
4. Find the square root of $18\frac{1}{2}$ and the cube root of $74\frac{1}{17}$.

5. A person bought 250 yds. of calico at 3 yds. for 1s. 6d., and 75 yds. at 2 yds. for 7½d., and sold the whole at 5 yds. for 2s. 1d.; what was the loss?

6. Find by practice the cost of 6 tons 3 cwt. 1 qr. at £1 4s. 2½d. per cwt.

EXERCISE CLXXXIII.

1. A gentleman pays £19 11s. 1½d. income-tax at 7d. in the £; required his yearly income.

2. A carpet 27 in. wide cost £11 for covering a room 16 ft. 3 in. long, and 14 ft. 9 in. wide; how much did the carpet cost per yard?

3. A bankrupt owes £5246 10s.; he has £529 15s. 9d. in cash, and can pay 15s. 3d. in the £; what is the value of his assets?

4. A room 16 ft. long, 14 ft. wide, and 11 ft. high cost for papering £1 2s. 6d. and for carpet £15; both were 27 in. wide; what was the price paid per yard respectively?

5. What fraction of 6s. 3¼d. is £68 16s., and 3 qrs. 2 nls. of 6 yards?

6. The cost per day for bread supplied to a regiment of 800 men is £11 5s. when bread is 1½d. per loaf; how much will it cost per week to supply bread to a regiment of 1000 men when it is 1¼d. per loaf?

EXERCISE CLXXXIV.

1. A waterman rows from a certain place at the rate of 6 miles an hour with the stream, which is running at the rate of 2½ miles an hour. Another boatman leaves the same place 10 minutes after, and overtakes the other 10 miles off. They then return. When the latter man reaches the place from which they started, where will the other man be?

2. Find by practice the cost of 63 yds. 2 qrs. 2 nls. of cloth at 15s. 4½d. per yard?

3. A bankrupt owes £7640. What must his assets be worth so as to pay 6s. 9d. in the £?

4. Simplify $\frac{2\frac{1}{3} + 1\frac{1}{9}}{23\cdot6} \times \frac{1\frac{1}{3} - 1\frac{8}{9}}{6\frac{1}{3} \div 2\frac{1}{7}}$.

5. Extract the square root of $469\frac{1}{4}$, and the cube root of 12·977875.

6. If 6 men can shear 100 sheep in 8 hours, how many days of 7 hours each would it take 4 men to shear 375 sheep?

EXERCISE CLXXXV.

1. A cloth dealer buys 3 pieces of cloth, each measuring $26\frac{1}{2}$ yds. for £32 10s; one piece is lost in transit; at what price per yard must the remainder be sold to cover his loss?

2. Find by practice 35 miles 7 fur. 25 pls. at £6 10s. $1\frac{1}{2}$ d. per mile?

3. Find the cost of carpeting a room 18 ft. 6 in. long and 12 ft. 6 in. broad with carpet $\frac{3}{4}$ yard wide, at 3s. 2d. per yard.

4. Find the value of £·0048 and ·0007s., and subtract the sum from £3·406.

5. Extract the square root of 531441 and the cube root of 1273760704.

6. If the 6d. loaf weigh 4 lbs. when wheat is 8s. 6d. per bushel, how much will the 7d. loaf weigh when wheat is 10s. 9d. per bushel?

EXERCISE CLXXXVI.

1. Find the value of £·2476 and ·0048s., and subtract the sum from £5·203.

2. Find by practice the dividend on 4090 at 6s. $4\frac{3}{4}$ d., and 8 miles 3 fur. 16 pls. at £2 16s. $6\frac{1}{4}$ d. per fur.

3. It took $49\frac{1}{4}$ yards of carpet to cover a room 18·5 ft. by 14 ft.; required the width of the carpet.

4. Divide 3 miles 6 fur. by 4 fur. 36 pls., and express the quotient as the decimal of a pole.

5. Find the square root of 642, and the cube root of .0001357.

6. In a factory 60 men turn out on an average 20 chairs per day ; in what time would 15 men turn out 30 arm-chairs, supposing these took half as much time again as the others ?

EXERCISE CLXXXVII.

1. In 21 guineas 21 pounds 21 shillings and 3s. 9½d. how many halfpence? How far would they extend if placed in a line, the diameter of each being one inch ?

2. Find by practice the dividend on 90014 at 17s. 9½d., and the cost of 2 qrs. 18 lbs. 14 oz. at 3s. 11¾d. per lb.

3. A room 14 ft. wide took 49½ yards of carpet 1 ft. 9 in. wide ; required the length of the room.

4. Find the sum, difference, product, and quotient of 16½ and 3½.

5. An equal-sided cistern contains 15625 cubic feet of water ; required the length of a side.

6. If 12 men can lay on an average 1 yard of rail per day of 8 hours each, in how many weeks of 9 hours per day would 75 men lay 14 miles ?

EXERCISE CLXXXVIII.

1. How much must be added to £48 17s. 9¾d. to make it exactly divisible by 289 ?

2. Find by practice 64 cub. yds. 23 cub. ft. 1215 cub. in., at £8 16s. 4d. per cub. yd.

3. A room 18 ft. 6 in. long took 49 yds. 1 ft. of carpeting 21 in. wide ; required the width of the room.

4. Divide 4 miles by 2 miles 1 fur. 20 ft., and bring the quotient to the decimal of a furlong.

5. The area of a square field is 3 a. 3 rds. 20 ft. ; required the length of one of the hedges.

6. If 45 lbs. of butcher's meat serve a family of 5 persons a week, how much will be necessary for 9 persons for one day?

EXERCISE CLXXXIX.

1. Find by practice the dividend on 2306 at 2s. 6d., 3s. 4d., 6s. 8d., and 12 lbs. 15 oz. 12 drs. at £1 6s. 9½d. per lb.

2. A gentleman's income is £670 10s. a-year; he pays £19 11s. 1½d. income-tax; how much is this in the £?

3. Reduce $\frac{3}{11}$, $\frac{9}{11}$, $\frac{2}{3}$ to decimals, and express as vulgar fractions .135, .249, .5201.

4. Find by practice the rent of a farm consisting of 126 a. 2 rds. 30 pls. at £4 5s. 6d. per acre.

5. The paper for the walls of the room referred to in Question 3 of the preceding Exercise cost £1 5s., the walls were 11 ft. 6 in. high, and the paper 30 in. wide; what was the cost per yard?

6. Add together $\frac{1}{3}$ square mile, $\frac{2}{3}$ a., and 20 sq. yds. Reduce to feet, and divide by .0054.

EXERCISE CXC.

1. Find by practice 25 sq. yds. 8 sq. ft. 130 sq. in. at £1 0s. 9½d. per sq. yd.

2. A bankrupt's assets are £864; he can pay 3s. 2½d. in the £; what is the amount of his debts?

3. Multiply .4532 by .05, and divide $2\frac{5}{11}$ by $3\frac{3}{4}$; express the quotient as a decimal.

4. Divide £8470 4s. among 6 persons, in the proportion of 4, 7, 9, 12, 15.

5. If A can do $\frac{2}{3}$ rds of a piece of a work in 3 hours, and B $\frac{2}{3}$ ths of the remainder in 1 hour, and C can finish it in 25 minutes, in what time could they do it, all working together?

6. The wheel of a railway truck is 9 ft. 3 in. in circumference; how many times will it revolve in travelling 110 miles?

FIFTH PART.

INTEREST, Discount, and Stocks are now to be considered ; and to those who have read our remarks on Proportion, and worked out the exercises, Interest will present no new difficulty, but Discount and Stocks are rarely regarded by young people as a "labour of love." I will, however, endeavour to smooth their way by giving such illustrations of the subject as will make it fairly simple to thoughtful students ; and remember, only those who are thoughtful will succeed in this study.

Interest.—The money you pay for the loan of a house you call "rent," for the loan of a horse "hire," for the loan of a person's services "wages," and for the loan of money "interest." You cannot have the use of a person's house, horse, services, or money, without returning what has been borrowed, and something in addition for the loan of it.

Suppose I want £300, and my friend, Mr. Jones, has this amount to spare, and is willing to lend it to me at 5 per cent. per annum. What am I to understand by this language ?

- (a) £300 is the sum to be lent, which will have to be *repaid* at a future time, subject to agreement ; this sum is called Principal.
- (b) Five per cent. : this means £5 for every £100, and as I propose to borrow £300, I shall have to pay £15 a year as long as the loan continues. This £15 is called Interest and the 5 per cent. the *rate* per cent.

- (c) Per annum : this means for every year the loan continues, just as we say a house is £40 a year, and we know that the rent will be payable as long as the house is occupied, most likely £10 per quarter ; but interest is usually paid half-yearly, so that I should have to pay £7 10s. to Mr. Jones every six months.

Say, at the end of three years, I am prepared to pay off my loan, so I take £300, principal, and £7 10s., last six months' interest, making together £307 10s., which is called the *Amount*.

In all interest questions three terms are given to find the answer, so that by the rule already given for Proportion all such questions can be worked out ; but as most of them only require the interest to be found, they had better be worked out as follows.

Example 1.—What will be the interest of £476 10s. 6d. for $4\frac{1}{2}$ years, at $3\frac{1}{4}$ per cent. per annum ?

£	s.	d.
476	10	6
		$4\frac{1}{2}$
2144	7	3
		$3\frac{1}{4}$
£69,69	10	$9\frac{3}{4}$
20		
s.13,90		
12		
d.10,89		
4		
3,59		
<i>Ans. £69 13s. 10$\frac{3}{4}$d. +</i>		

It will be seen that the *Principal* is multiplied by the time and rate per cent., and divided by 100, by cutting off the two figures on the *right* hand, commencing with the £, and so on to the end. Fractions of a penny are usually omitted ; here it is, $\frac{89\frac{3}{4}}{100}$ or $\frac{3}{4}$ d. + $\frac{59}{100}$ of a farthing.

Hitherto we have spoken of *Simple* Interest, that is, when it is paid as rent is paid ; but in some cases the interest is left to accumulate ; for instance, suppose Mr. Jones referred to above is going abroad for three years, and tells me I must add the interest to the

principal every six months, and pay him altogether on his **return** ; in which case I shall have to work out a sum like this :—

£	s.	d.	
300	0	0	
7	10	0	
<hr/>			
307	10	0	= first six months.
7	13	8	
<hr/>			
315	3	8	= second six months.
7	17	7	
<hr/>			
323	1	3	= third six months.
8	1	6	
<hr/>			
331	2	9	= fourth six months.
8	5	6	
<hr/>			
339	8	3	= fifth six months.
8	9	8	
<hr/>			
347	17	11	= sixth six months.
<hr/>			

The amount due at the end of three years is £347 17s. 11d., or £300 principal and £47 17s. 11d. compound interest, which has been ascertained by making it up at the end of every six months, adding the interest to the principal, and proceeding as before.

The simple interest would be £45, or £2 17s. 11d. less than the compound interest.

Discount.—A jeweller offers 5 per cent. discount for cash ; you purchase an article amounting to £30, the tradesman takes off 30s., and you pay £28 10s., but are supposed to possess an article worth £30.

A banker is doing business at 5 per cent. discount ; you take him a bill of exchange, which is stamped, and on it certain persons promise to pay £30 twelve months hence to anyone who may be in possession of this bill ; the banker, having faith in the persons whose names are affixed, buys it, or cashes it, and you throw him back 30s., and he gives you £28 10s., he taking possession of the bill, which will be worth £30 in twelve months.

This is called “banker’s discount,” and is calculated the same way as interest.

Days of grace.—It is the universal custom with bankers to allow

three days after the time named in the bill for payment ; but you must remember that interest, or discount, as it is called, is charged for those days ; so that if you had a £30 bill drawn on January 1, payable 3 months after date, and desire to ascertain the discount, you have to reckon 3 months and 3 days, thus :

£30 for 3 mths. 3 days at 5 per cent. per annum.

	s.	d.
3 months =	7	6
3 days =	10	
	<hr/>	<hr/>
	8	4

The banker would deduct 8s. 4d. out of the £30, handing you £29 11s. 8d. in exchange for the bill, which the persons responsible will have to take from the banker on April 4th, on payment of £30.

True discount.—I am not aware that this rule is required in the transactions of daily life ; nevertheless, as we find it in books and set in examination papers, we are bound to understand its meaning. We have seen that there is but trifling difference between banker's discount and interest, one being allowed at the commencement of a transaction, the other some time after ; we have also seen that the present value of the £30 bill drawn for 12 months is £28 10s. (omitting days of grace), and the one drawn for 3 months is £29 11s. 8d. ; so that to ascertain the present value of an amount due some time hence is to find the interest, and deduct from it according to the banker's discount.

"True discount" is a little more complicated. Suppose you have two bills of exchange for £105 each, payable in 12 months, and wish to turn them into cash ; the current rate of interest is 5 per cent. You cash one at the bank and receive (as explained before, omitting the days of grace) £99 15s. The other is cashed by a private friend, who only deducts £5, handing you over £100. This is "true" discount. which, on this transaction, amounts to a difference of 5s. To work out questions when true discount is required, what you have to remember is, to add the rate to £100 as a standard, and make a proportion sum of the question, thus :

If 3 per cent. be the rate, then	£3	is the true dis. on	£103.
„ 4½	„	„	£4 10s.
„ 7½	„	„	£7 15s.
		„	£104 10s.
		„	£107 15s.

Example.—What is the true discount and present worth of £761, due six months hence, at $4\frac{1}{2}$ per cent.?

$$\begin{array}{r} \text{As } 104\frac{1}{4} : 761 :: 4\frac{1}{2} \\ \hline 761 \quad 4\frac{1}{2} \\ \hline 104\frac{1}{4} = £31. \end{array}$$

£31 is the true discount for 12 months, because I have taken this as my standard, viz. $4\frac{1}{2}$ on $104\frac{1}{4}$ for 12 months; but the £761 is due in six months, therefore the true discount is $£31 = £15$ 10s.

Now take £15 10s. from £761 = £745 10s., the present worth.

Stocks.—This is a subject over which I have spent hundreds of hours endeavouring to explain and simplify the terms usually employed, but, except to those of mature age, I have found it a hard task, inasmuch as “Turkish bonds,” “Railway debentures,” “ $3\frac{1}{2}$ per Cents,” “Consols,” &c., are altogether foreign and unknown words to juveniles; but if they would only translate those terms, and substitute for them “£100 cottages,” the neck of the difficulty would be broken.

Suppose the Government resolved to build 10,000 cottages at £100 each with borrowed capital, to let them at £3 10s. a year, to name them “the $3\frac{1}{2}$ per Cents,” to sell them to the public as they are finished, and to guarantee the rent (£1 15s.) every six months. Suppose you buy ten, making the best bargain you can; having got them, you say, “I have £1000 in the ‘ $3\frac{1}{2}$ per Cents Cottages,’” because each cottage always represents £100, and the rent never varies. Whoever owns the cottages, even if they are given to him, will be entitled to receive $10 \times £1$ 15s. every six months. Now, suppose you desire to sell some or all the cottages; if money is very plentiful you may make £105 each, or, if money is very scarce, you may only make £80 each. Thus the price goes up and down, according as money is plentiful or scarce, or as the Government who build the cottages are relied on or doubted.

Now note two or three things.

- (a) The original cost of each is £100; it always represents this amount, and is spoken of as such, but is different from having £100 in the pocket or in the bank.
- (b) The income from this source remains unaltered; the interest, or dividend, as it is called, is in no way affected by the price paid for the principal.

(c) Buying and selling in the Stocks is a business carried on by stockbrokers, whose usual charge is $\frac{1}{8}$ th per cent., that is, 2s. 6d. each (say each cottage), so that if you buy or sell ten (no matter what the price is) he charges for commission $10 \times 2s. 6d. = \pounds 1\ 5s.$

(d) " $4\frac{1}{2}$ per Cents at $89\frac{1}{4}$, commission $\frac{1}{8}$ th per cent.," means that for $\pounds 89\ 5s.$, and 2s. 6d. to the broker, a share in the Stocks, which represents $\pounds 100$, can be purchased, and will yield an income of $\pounds 4\ 10s.$ per annum.

"Railway shares paying 5 per cent. are at $\pounds 5$ premium," means that the shares were originally $\pounds 100$, now yield $\pounds 5$ a year each, and sell at $\pounds 105$ (although the dividend will in no way be affected by the price of the share).

I hope I have said enough to make my readers understand that the principal money coming under the head of "Stocks" was originally borrowed from the public in $\pounds 100$ shares, and *sunk* in costs for the army, navy, railways, and other public works; therefore they cannot be redeemed; but the *scrip*, which may be compared to bank notes, are bought and sold at varying prices, according to the state of the money market.

Shares in public companies, such as banks, water, gas, &c., are not, like Stock shares, uniformly of one original price ($\pounds 100$), but vary, and the price is always named.

Examples.—I desire to know the sum required to purchase $\pounds 5000$ stock in each of the following, and what would be the annual income. Also 50 gas shares.

(a) $4\frac{1}{2}$ per Cents stock at $97\frac{1}{2}$.

(b) $3\frac{1}{2}$ " " " $86\frac{3}{4}$.

(c) 5 " Consols " $107\frac{1}{2}$.

(d) Gas shares, $\pounds 50$ paid up, paying 4 per cent., and selling at 36.

(a) $\therefore 50 \times \pounds 97\frac{1}{2}$ = cost of $\pounds 5000$ stock, $50 \times \pounds 4\frac{1}{2}$ = annual income.

(b) $\therefore 50 \times \pounds 86\frac{3}{4}$ = " " " $50 \times \pounds 3\frac{1}{2}$ = " "

(c) $\therefore 50 \times \pounds 107\frac{1}{2}$ = " " Consols, $50 \times \pounds 5$ = " "

(d) $\therefore 50 \times \pounds 36$ = " 50 gas shares, $50 \left(\frac{\pounds 4 \times 50}{100} \right)$ = " "

Stockbroker's commission must be added to cost.

EXERCISE CXCI.

1. Find the simple interest on £650 10s. for $2\frac{1}{2}$ years, at 4, 5, and 6 per cent.
2. Find the simple interest on £210 from March 10th to August 17th, at 4 and at $4\frac{1}{2}$ per cent.
3. What sum will amount to

£506	in 3 years at 4 per cent. ?
£605	„ 4 „ $3\frac{1}{2}$ „
£476	„ 5 „ $2\frac{1}{4}$ „
4. Find the compound interest and the amount of

£200	at 5 per cent. for 3 years.
£150	„ 4 „ „ 4 „
£100	„ $4\frac{1}{2}$ „ „ 2 „

N.B. omit fractions of a penny.
5. A ship and cargo are worth £7507 10s.; the rate of insurance is $2\frac{1}{2}$ per cent. ; for what amount should the insurance be effected so as to cover the risk of ship, cargo, and premium ?
6. Having £2000 in cash, I invest it in the 3 per Cents at 95 ; required the yearly income for the same.

EXERCISE CXCII.

1. Find the simple interest on £386 15s. for $7\frac{3}{4}$ years at $3\frac{1}{2}$, $4\frac{1}{2}$, and $5\frac{1}{2}$ per cent.
2. Find the simple interest on £864 10s. from December 1st to February 12th, at $6\frac{1}{4}$ per cent.
3. What sum will amount to

£4561	in 4 years at $2\frac{1}{2}$ per cent. ?
£4921	„ $3\frac{1}{2}$ „ 3 „
£1294	„ 4 „ $3\frac{1}{2}$ „
4. Find the compound interest and amount of

£250	at 5 per cent. for 4 years.
£200	„ $4\frac{1}{2}$ „ „ 3 „
£300	„ 3 „ „ 5 „

Omit fractions of a penny.

5. What will be the cost of insuring £1025 0s. 10d. at $3\frac{1}{8}$ per cent. premium and $\frac{1}{8}$ per cent. brokerage?

6. I bought £2000 stock in the 3 per Cents at $94\frac{1}{8}$ and sold out at $96\frac{1}{4}$; commission on each transaction, $\frac{1}{8}$ per cent.; how much was my gain?

EXERCISE CXCIIL.

1. Find the simple interest on £492 2s. 6d. for 4 years 3 months at $2\frac{1}{2}$, $5\frac{1}{2}$, $6\frac{1}{4}$ per cent.

2. Find the simple interest in £489 15s. from February 4th, 1864, to September 1st, at $5\frac{1}{4}$ per cent.

3. What sum will amount to

£987 10s. in $4\frac{1}{4}$ years, at 5 per cent.

£789 " $3\frac{1}{2}$ " 4 "

£1064 5s. " 6 " $3\frac{1}{4}$ "

4. Find the compound interest and amount of

£340 at $4\frac{1}{2}$ per cent., for 2 years.

£400 " $3\frac{1}{4}$ " " 3 "

£250 " $5\frac{1}{2}$ " " $2\frac{1}{2}$ "

Omit fractions of a penny.

5. A commission agent, whose terms were $1\frac{1}{8}$ on all separate accounts above £300, and $1\frac{3}{8}$ on accounts between £100 and £300, and $1\frac{1}{4}$ on those of smaller sums, collected £80, £95 10s., £205, £640 15s., £60, £1400, £296 10s. from different persons; required the amount of his commission.

6. Find the difference of income from £1000 invested in the $3\frac{1}{2}$ per Cents at $89\frac{1}{2}$, and £1000 invested in railway shares at 106, paying £5 per share.

EXERCISE CXCIIV.

1. Find the simple interest on £540 7s. 6d. for 5 years 10 months at $3\frac{1}{4}$, $4\frac{1}{2}$, and $5\frac{1}{4}$ per cent.

2. Find the simple interest in £3560 from January 6th, 1873, to August 7th, 1874, at $3\frac{1}{2}$ per cent.

3. What sum will amount to

£2340 17s. 6d. in 5 years at $3\frac{1}{8}$ per cent.

£3401 15s. „ $6\frac{1}{2}$ „ 4 „

£2510 10s. „ $8\frac{1}{4}$ „ $5\frac{1}{2}$ „

4. Find the compound interest and amount of

£1000 at 5 per cent. for $3\frac{1}{2}$ years.

£650 „ $4\frac{1}{2}$ „ „ 4 „

£560 „ $3\frac{1}{4}$ „ „ 3 „

Omit fractions of a penny.

5. A holds a bill of exchange for £105 payable 12 months hence (omit days of grace); the rate of interest is 5 per cent.; how much would be received if cashed at a bank? how much if true discount were charged?

6. A gentleman invests £2740 in the 3 per Cents at $85\frac{1}{2}$; four months after he receives the first half year's dividend, and sells out at $£85\frac{7}{8}$, paying $\frac{1}{8}$ per cent. commission on each transaction; required the rate per cent. per annum which the investment realised.

EXERCISE CXCIV.

1. Find the simple interest on £120 10s. for 3 years 5 months at $4\frac{1}{2}$, $5\frac{1}{4}$, $6\frac{3}{4}$ per cent.

2. Find the simple interest on £4601 17s. 6d., from March 19th to December 25th, at £6 2s. 6d. per cent.

3. What sum will amount to

£847 10s. in 5 years 2 months, at 4 per cent.

£748 10s. „ 4 „ 5 „ „ $4\frac{1}{2}$ „

£391 5s. „ 3 „ 9 „ „ $5\frac{1}{4}$ „

4. Find the compound interest and amount of

£456 at 3 per cent. for $3\frac{1}{2}$ years.

£260 10s. „ $4\frac{1}{2}$ „ „ 4 „

£2961 15s. „ $5\frac{1}{4}$ „ „ $3\frac{3}{4}$ „

Omit fractions of a penny.

5. A has an offer from his wine merchant of 12 months' credit or 5 per cent. discount for cash; he buys £300 worth of wines, and it not being convenient to pay in cash, he accepts a bill of exchange for £300 payable in 12 months (omit days of grace), which his banker

cashes at $4\frac{1}{2}$ per cent. discount; with this he pays his wine bill; what does he gain by it?

6. By investing in bank shares at £63 each, which are paying $12\frac{1}{2}$ per cent., I receive an income of £787 10s.; how many shares do I hold? and what rate per cent. do the original shareholders who purchased at £50 receive?

EXERCISE CXCVI.

1. Find the simple interest on £1640 for 6 years 7 months, at $2\frac{1}{2}$, $3\frac{1}{4}$, $4\frac{1}{8}$ per cent.

2. Find the simple interest on £854 12s. 6d., from May 16th, 1860, to June 12th, 1870, at $3\frac{1}{2}$ per cent.

3. In what time will

£64 amount to £74 at $5\frac{1}{2}$ per cent.?

£105 „ £150 „ 6 „

£13 „ £30 „ $3\frac{1}{4}$ „

4. What is the difference between the simple and compound interest on £1640 for 3 years at $3\frac{1}{2}$ per cent. interest, reckoned every 6 months?

5. Find the amount of banker's discount on a 3 months' bill, drawn March 1st, for £265, at 5 per cent. (include days of grace).

6. A gentleman transfers £3000 in the $3\frac{1}{2}$ per Cents. at 72, to the 4 per Cents. at 76; what is the difference in his income?

EXERCISE CXCVII.

1. Find the simple interest on £2804 10s., for 3 years 8 months, at $3\frac{1}{8}$, $4\frac{1}{4}$, $5\frac{1}{4}$ per cent.

2. Find the simple interest on £3521 15s., from January 1st to September 4th, at $6\frac{1}{8}$ per cent.

3. In what time will

£46 amount to £50, at $4\frac{1}{2}$ per cent.?

£126 10s. „ £135 „ 5 „ „

£207 15s. „ £250 „ $5\frac{1}{4}$ „ „

4. What will £250 amount to in two years, at 6 per cent., compound interest, reckoned every six months?

5. A and B enter into partnership; A advances £4000, B £5000; after 3 months A withdraws 10 per cent., one month from this time B withdraws 5 per cent.; at the end of the year the profits amount to £760; find their respective shares.

6. What amount must be invested in the $4\frac{1}{2}$ per Cents, at $89\frac{1}{2}$, commission $\frac{1}{8}$ th per cent., to realise £200 per annum after paying 5d. in the £ income-tax?

EXERCISE CXCVIII.

1. Find the simple interest on £4068 15s., for 5 years $2\frac{1}{2}$ months, at $3\frac{1}{2}$, $5\frac{1}{2}$, $6\frac{1}{2}$ per cent.

2. Find the simple interest on £257 10s. from March 20th to October 9th, at $3\frac{3}{4}$ per cent.

3. In what time will

£24 15s. amount to £35, at $3\frac{1}{2}$ per cent.?

£129 10s. " " £150 " 4 "

£250 " " £300 " $4\frac{1}{2}$ "

4. What will £2645 amount to in $1\frac{1}{2}$ years, at 4 per cent. compound interest, reckoned quarterly?

5. Find the present value of £345, due in four months, at 3 per cent. per annum, true discount.

6. A gentleman invests £10000 in the 3 per Cent. Consols at $94\frac{1}{8}$; three months after he receives the first half year's dividend and sells out $\frac{1}{2}$ of his stock at $95\frac{1}{4}$; one month after receiving the second dividend he sells the remainder of his stock at $94\frac{7}{8}$, paying $\frac{1}{8}$ per cent. commission on each transaction; find the rate per cent. per annum realised.

EXERCISE CXCIX.

1. Find the simple interest on £961 12s. 6d., for 4 yrs. 11 mos., at £3 2s., £4 4s., £5 6s. per cent.

2. Find the simple interest on £756 14s. from June 13th to February 4th, at $4\frac{1}{8}$ per cent.

3. In what time will

£876 amount to £1000, at $3\frac{1}{8}$ per cent. ?

£367 " " £420 " 4 "

£570 " " £600 " $5\frac{1}{4}$ "

4. What will £750 amount to in $1\frac{1}{4}$ years, at $3\frac{1}{2}$ per cent., compound interest, reckoned quarterly ?

5. A merchant sells goods to a customer at a profit of 60 per cent.; the customer becomes a bankrupt, and pays 2s. 6d. in the £; what is the actual loss of the merchant ?

6. A person holds 40 bank shares of £30 each, paying $6\frac{1}{2}$ per cent., and 5000 railway stock at 108, paying $4\frac{1}{2}$ per cent.; he sells out and invests the whole in the $5\frac{1}{2}$ per Cents at 90; charge $\frac{1}{8}$ th per cent. commission in the latter case, and find the alteration in his income.

EXERCISE CC.

1. Find the simple interest on £846l 17s. 6d. for 6 yrs. 5 mos., at $2\frac{3}{4}$, $3\frac{3}{8}$, $4\frac{7}{8}$ per cent.

2. Find the simple interest on £3040 from December 6th, 1871, to June 12th, 1876, at $4\frac{1}{4}$ per cent.

3. In what time will

£1000 amount to £1500, at 6 per cent. ?

£265 " " £305 " $5\frac{1}{2}$ "

£456 " " £500 " $3\frac{1}{8}$ "

4. What is the compound interest in £1670, for $2\frac{1}{2}$ years, at 5 per cent., the interest reckoned every 6 months ?

5. An engine was erected at a cost of £457 19s. 6d.; find its value at the end of two years; the depreciation allowed is 6 per cent. per annum, and $2\frac{1}{2}$ per cent. for wear and tear.

6. How much must a father invest at the birth of a child in the $3\frac{1}{2}$ per Cents, that the stock and accumulated interest may amount to £5000 when the child is 20 years old, supposing he buy and sell at $82\frac{1}{2}$ (omitting commission) ?

EXERCISE CCI.

1. Find the simple interest on £246, for 6 years 20 days, at 3, 4, $5\frac{1}{2}$ per cent.
2. At what rate per cent. will £816 amount to £856 16s. in one year?
3. What will £500 amount to in $3\frac{1}{2}$ years, at $2\frac{1}{2}$ per cent., and £1620 in 7 years, at $3\frac{1}{4}$ per cent.?
4. What sum lent at compound interest will amount to
 £200 in 2 years, at 5 per cent.?
 £120 „ $1\frac{1}{2}$ „ 4 „
 £350 „ 3 „ 5 „
5. A person first bought 3 lbs. of tea and 1 lb. of coffee for 16s., then $33\frac{1}{3}$ per cent. less tea and 100 per cent. more coffee, paying the like sum as at first; find the price per lb. of tea and coffee.
6. A person transfers his capital, which consists of railway shares at 108, paying $4\frac{1}{4}$ per cent., to a 4 per cent. stock at 75; find the increase or decrease per cent. in his income.

EXERCISE CCII.

1. Find the simple interest on £579 10s., for 3 years 215 days, at $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{4}$ per cent.
2. At what rate per cent. will £617 10s. amount to £700 in one year.
3. What will
 £614 amount to in $2\frac{1}{4}$ yrs., at 5 per cent.?
 £276 „ „ $5\frac{1}{2}$ „ „ $6\frac{1}{2}$ „
 £589 „ „ $3\frac{3}{4}$ „ „ $2\frac{1}{2}$ „
4. What sum lent at compound interest will amount to
 £250 in 2 years, at 4 per cent.?
 £386 „ 3 „ „ 5 „
 £420 „ $1\frac{1}{2}$ „ „ 4 „
5. If I gain ten per cent. by selling at 16s. 6d. per yd., what was the cost price?
6. A person sells out £3250 in the 3 per Cents at 71, and buys in

the $3\frac{1}{2}$ per Cents at $76\frac{1}{8}$, paying the usual brokerage ; find how his income is affected.

EXERCISE CCIII.

1. At what rate per cent. will £212 amount to £220 in 340 days ?
2. What is the difference between the simple and compound interest on £4689, at $5\frac{1}{2}$ per cent. for one year ?
3. I wish to gain 20 per cent. on apples which cost $2\frac{1}{2}$ d. per doz. ; at what price must each be sold ?
4. Show by a comparison of rate per cent. which would be the best to invest in, £25 bank shares at 63, paying $10\frac{1}{8}$ per cent., $3\frac{1}{2}$ per Cents stock at $79\frac{1}{4}$, or railway shares at 118, paying 5 per cent.
5. Find the simple interest on £2104 12s. 6d. for 7 yrs. 17 days, at $3\frac{1}{8}$, $4\frac{1}{8}$, $5\frac{1}{8}$ per cent.
6. At what rate per cent. will £8690 amount to £10000 in two years ?

EXERCISE CCIV.

1. Find the simple interest on £496 17s. 6d. for 4 yrs. 150 days, at $1\frac{1}{2}$, $2\frac{1}{4}$, $3\frac{1}{8}$ per cent.
2. At what rate per cent. will £650 amount to £700, in 2 years ?
3. At what rate per cent. will £645 amount to £680, from March 1st to December 26th.
4. What sum lent at compound interest will amount to
 £245 in 1 yr. 6 mos., at 5 per cent. reckoned half yearly ?
 £130 " 2 " " 5 " " " " "
 £300 " 2 " 6 mos. " 5 " " " " "
5. Sold 12 lbs. of potatoes for 5d. at a profit of 25 per cent. ; find the profit if they had been sold for 6d., and if 8 lbs. were sold for 3d.
6. A company's whole capital is £100000 ; paid their shareholders $7\frac{1}{2}$ per cent. ; the working expenses amounted to 65 per cent. of the income ; required the gross income.

EXERCISE CCV.

1. Find the simple interest on £4615 for 8 yrs. 205 days, at $4\frac{1}{8}$, $5\frac{1}{2}$, $6\frac{1}{4}$ per cent.
2. At what rate per cent. will £784 amount to £1000 in $2\frac{1}{2}$ years?
3. At what rate per cent. will £1040 amount to £1100, from August 6th to February 7th?
4. What is the difference between the simple and compound interest on £100, at 5 per cent., for 2 years' interest, reckoned quarterly?
5. Find the present value of £315 10s., due 9 months hence, at 5 per cent. discount. And how much would a banker hand over in cashing a bill for £216 10s., drawn January 1st for 6 mos., and cashed March 4th at $4\frac{1}{2}$ per cent. discount?
6. A gentleman having ten houses, which pay him an average yearly rental of £22 10s., which is $4\frac{1}{2}$ per cent. on his capital, he sells at par and invests in the 4 per Cents at $89\frac{1}{8}$; how will his income be affected? Reckon the usual brokerage on the latter transaction.

EXERCISE CCVI.

1. Find the simple interest on £2090 5s. for 3 yrs. 318 days, at $2\frac{1}{8}$, $3\frac{1}{4}$, $4\frac{1}{2}$ per cent.
2. At what rate per cent. will £321 amount to £371 in $3\frac{1}{2}$ yrs.?
3. What will £321 amount to at $3\frac{1}{4}$ per cent., from March 6th to September 12th?
4. How long before the interest on £560 at $3\frac{1}{2}$ per cent. simple interest would amount to £80?
5. A ship valued at £4250, and cargo at £10370, are insured at $3\frac{1}{2}$ per cent.; for what amount must the insurance be effected to cover the risk of ship, cargo, and premium?
6. How much must a gentleman invest in the 3 per Cents at $78\frac{1}{4}$, exclusive of brokerage, to realise £500 a year?

EXERCISE CCVII.

1. Find the simple interest on £946 2s. 6d., for 5 yrs. 160 days, at $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{8}$ per cent.
2. At what rate per cent. will £850 amount to £930 in $2\frac{3}{4}$ years?
3. What will £123 10s. amount to at $5\frac{1}{2}$ per cent., from June 1st to December 3rd.
4. Suppose an account amounting to £186 17s. 6d. was due January 1st, 1864, from which date interest was charged at the rate of 5 per cent., what sum would be due February 6th, 1866?
5. What is the worth on July 1st of £230 15s., payable December 3rd, at 4 per cent., true discount (no grace days).
6. A gentleman having £8650 Consols paying £31 4s. 6d. per cent., leaves one half to his nephew and the remainder to be equally divided among his three nieces; required the income of each.

EXERCISE CCVIII.

1. Find the simple interest on £649 17s. 6d. for 2 years $2\frac{1}{2}$ months, at $2\frac{1}{2}$, $3\frac{1}{4}$, $4\frac{1}{4}$.
2. At what rate per cent. will £754 15s. amount to £800 in $1\frac{1}{2}$ years?
3. What will £3764 amount to at $3\frac{1}{8}$ per cent. from September 2nd to February 19th?
4. A tradesman charges 3 per cent. on overdue accounts; A's bill of £23 5s. was due March 1st, B's £416 on March 16th, C's £572 10s. on April 6th, D's £325 15s. on June 1st; required the total amount due December 25th.
5. What amount would be received at a bank for 6 months' bill drawn March 6th for £76, and cashed May 27th (4 per cent.)?
6. A person buys an estate for £3600; how much stock must he sell out of the $3\frac{1}{2}$ per Cents at $89\frac{1}{8}$ in order to pay for it? (omit brokerage).

EXERCISE CCIX.

1. Find the simple interest on £5040 for 7 years, $5\frac{1}{2}$ months, at $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$ per cent.
2. At what rate per cent. will £17 10s. amount to £20 in nine months?
3. What will £4672 amount to at $4\frac{1}{2}$ per cent. from Aug. 6th to Jan. 3rd?
4. A borrows £685, at $4\frac{1}{2}$ per cent. ; he pays back £100 in 3 months, £240 more 2 months after ; what balance, including interest, will be due 9 months from date of loan?
5. A tradesman offers 5 per cent. discount for cash ; what amount of goods can be purchased for £5?
6. What amount of capital is required to buy £3050 stock in the $3\frac{1}{2}$ per Cents at $86\frac{1}{2}$, and £2100 in the $4\frac{1}{2}$ per Cents at $95\frac{1}{8}$; $\frac{1}{8}$ per cent. brokerage? and what would be the half-yearly income?

EXERCISE CCX.

1. At what rate per cent. will £54 15s. amount to £60 15s. in 325 days?
2. What will £4961 amount to at $6\frac{1}{2}$ per cent. from Jan. 12th, 1874, to December 8th, 1875?
3. A lends B £200 at 5 per cent. January 2nd, and £300 March 1st. B repays the loan and interest June 1st with a £1000 note. A borrows the balance at the same rate of interest. How much will he owe December 3rd?
4. By how much will the compound interest on £1000 at 4 per cent. per annum for 2 years be increased by the interest being paid half-yearly instead of annually?
5. Find the simple interest on £8400 15s. for $6\frac{3}{4}$ years, at $2\frac{1}{2}$, $3\frac{1}{4}$, $5\frac{3}{4}$ per cent.
6. A gentleman invests £3000 in £50 railway shares at par, which pay $4\frac{1}{8}$ per cent. ; he allows his dividends to accumulate for 10 years ; the stock is then at £15 premium ; find the value of his property?

SIXTH PART.

As many questions in arithmetic can only be solved by the aid of Mensuration, it is well that every one should acquire a knowledge of, at least, the elementary rules, especially as they are as simple as they are valuable. They comprehend the Measurement of Surfaces or Areas and Solid Contents, and the most common system in use is duodecimals, which is really a "rule of thumb," but the result obtained by it is sufficiently correct for all practical purposes, and this, combined with its extreme simplicity, has led to its general adoption. All branches of the building trade use it, and call it "square measure ;" by it the workmen "square up" their work.

It is sometimes named "cross multiplication," the reason of which is self-evident. To acquire a first step to this system, take your slate and divide the shorter side into four equal parts, and the longer into six equal parts ; draw lines across at those distances both ways, as in the margin, and you will have 24 squares, the product of the two sides ($4 \times 6 = 24$). If twelve slates are ruled in the same manner and piled one on the other, you will have 288 squares, the result of $4 \times 6 \times 12$.

The area or superficial measurement is found to be 24, the cubic or solid contents 288 ; the first is obtained by multiplying the length by the breadth, the second by multiplying the three dimensions together, viz., length, breadth, and thickness.

Take the following example worked by duodecimals :

It is required to find the area of a floor which is 10 ft. 5 in. long and 6 ft. 3 in. wide.

State the question by placing one dimension under the other, feet under feet and inches under inches.

Commence with the 6 ft., *cross* to the 5 in. and say 6 times 5 are 30, 30 inches 2 ft. 6 in. ; place the 6 under inches ; then 6 times

ft.	in.		feet ; then take the 3 inches and say three times 5 are
10	5		15, which are said to be "parts," and 15 parts are
6	3		1 in. 3 parts ; put down the 3 one place to the right ;
62	6		then 3 times 10 + 1 are 31, 31 inches 2 ft. 7 in. ; place
2	7	3	the figures accordingly, add, and you have what is
65	1	3	usually read off as 65 ft. 1 in. 3 parts, the parts being
			generally discarded. You should observe that this

reading, although near enough for practical purposes, is not quite correct ; it is really $65 + \frac{1}{12} + \frac{3}{144}$ feet, or 65 ft. 15 in. (square measure).

A similar error is committed when in the "rule" it is said, "feet multiplied by inches give inches." You cannot square feet with inches any more than you can square yards with feet or pounds with shillings. If concrete numbers have to be squared, they must be reduced to the same denomination ; then yards multiplied by yards will give square yards, feet multiplied by feet will give square feet, and inches multiplied by inches will give square inches, and so on.

ft.	in.	in.		Take the above question and reduce the
10	5	=	125	10 ft. 5 in. to inches (125), and 6 ft. 3 in.
6	3	=	75	to inches (75) ; multiply these together
			9375	and you obtain 9375 square inches ; now
			<u>9375</u>	divide by 144, the number of square inches
				in a square foot, and you get the correct

$9375 \div 144 = 65 + 15$. answer, 65 sq. ft. 15 sq. in.

Or work it out by fractions thus :

$$10\frac{5}{12} \times 6\frac{3}{12} = 65\frac{15}{144}.$$

It will be seen that if exactness be required duodecimals will not give it without a knowledge of fractions, whereas by the second method above (which is strongly recommended for accuracy and simplicity) you require only a knowledge of the first four rules of arithmetic.

Example 2.—Find the superficial contents of a room 15 ft. 8 in. by 12 ft. 7 in.

ft.	in.		in.		
15	8	=	188		
12	7	=	151		
			<u>28388</u>	sq. in.	
28388	÷ 144	=	197	sq. ft. 20 sq. in.	

By fractions.

$$15\frac{8}{12} \times 12\frac{7}{12} = 197\frac{20}{144}$$

Ans. 197 sq. ft. 20 sq. in.

Example 3.—Find the solid contents of a baulk of timber, 16 ft. 4 in. long, 3 ft. 2 in. wide, and 3 ft. 6 in. thick.

ft.	in.		in.		
16	4	=	196		
3	2	=	38		
3	6	=	42		

$$196 \times 38 \times 42 = 312816$$

$$312816 \div 1728 = 181 + 48$$

By fractions :

$$16\frac{4}{12} \times 3\frac{2}{12} \times 3\frac{6}{12} = 181\frac{1}{36} \text{ or } 181\frac{48}{1728}$$

Ans. 181 cubic ft. 48 cubic in.

Example 4.—Find the area of a courtyard measuring 8 yds. 2 ft. 3 in. by 4 yds. 1 ft. 6 in.

yds.	ft.	in.		in.	
8	2	3	=	315	
4	1	5	=	162	
				<u>51030</u>	sq. in.
51030	÷ 144	=	354	sq. ft. 30 sq. in.	

By fractions.

$$26\frac{3}{12} \times 13\frac{6}{12} = 354\frac{30}{144}$$

Ans. 354 sq. ft. 30 sq. in.,
or 39 sq. yds. 3 sq. ft. 30 sq. in.

EXERCISE CCXI.

Multiply by duodecimals and fractions.

1. 9 ft. 4 in. by 5 ft. 3 in.
2. 8 „ 5 „ 6 „ 4 „
3. 4 „ 7 „ 7 „ 5 „

4.	6 ft. 2 in.	by	5 ft. 9 in.	
5.	7 " 5 "		6 " 5 " 2"	
6.	10 " 6 "		2 " 4 " 8"	
7.	9 " 9 "		9 " 1 " 6"	
8.	6 " 3 "		8 " 5 " 0"	
9.	12 " 7 "		4 " 11 " 2"	
10.	5 " 4 " 2"		2 " 10 " 0"	
11.	7 " 6 " 3"		2 " 4 " 1"	
12.	8 " 3 " 6"		5 " 0 " 4"	
13.	3 " 0 " 9"		6 " 1 " 0"	
14.	16 " 1 " 3"		4 " 2 " 6"	
15.	24 " 0 " 9"		8 " 0 " 3"	
16.	6 " 11 " 5"		3 " 6 " 5"	
17.	10 " 4 " 3"		2 " 5 " 7"	
18.	13 " 9 " 2"		7 " 9 " 4"	
19.	9 " 0 " 6"		5 " 0 " 2"	
20.	14 " 8 " 11"		6 " 11 " 0"	

EXERCISE CCXII.

1. Find the cost of paving a courtyard, measuring 15 ft. 6 in. by 12 ft. 4 in., at 1s. 3d. per sq. ft.
2. How much deal board 1 inch thick would be required to make a box with cover to fit in a recess 3 ft. 2 in. long, 2 ft. 6 in. wide, and 4 ft. 3 in. deep?
3. Find the cost of a piece of mahogany for counter top, 20 ft. 3 in. by 3 ft., at 9d. per ft.
4. Find the cost of covering a hall 10 ft. 5 in. by 8 ft. 9 in., with floorcloth 5s. 6d. per sq. yd.
5. What would it cost to paint the walls of a room measuring 14 ft. 2 in. long, 13 ft. 4 in. wide, and 11 ft. 9 in. high, at 8d. per square yard?

6. How much would it cost to line a box with zinc, at $4\frac{1}{2}$ d. per sq. foot, supposing the box to be made of board $1\frac{1}{2}$ in. thick, and the outside dimensions 9 ft. long, 2 ft. 3 in. wide, and 2 ft. 8 in. deep; the cover to be lined fair with the inside?

7. How much would it cost to line a cistern 8 ft. 10 in. long, 4 ft. 2 in. wide, and 3 ft. 7 in. deep, with lead at 2s. per square foot?

8. How much flooring would it take for a room, 17 ft. 6 in. by 15 ft. 7 in.?

9. How much would it cost to pave a terrace 250 ft. long, and 23 ft. 6 in. wide, at 2s. 9d. per square yard?

10. What is the solid contents of a block of granite, measuring 3 yds. 2 ft. by 7 ft. 5 in. by 5 ft. 10 in.? What would be its value at £2 per cubic yard?

11. How many cubic feet of air does a room contain which measures 13 ft. 3 in. long, 12 ft. 7 in. wide, and 11 ft. high?

12. What would it cost to glaze 16 windows, each measuring 8 ft. 3 in. by 4 ft. 6 in., at $10\frac{1}{2}$ d. per square foot?

13. Find the area of a rectangular field, measuring 30 pls. 2 yds. 1 ft. by 25 pls. 4 yds. 2 ft.

14. What would it cost to gravel a path 5 ft. wide on two sides of a square garden, the area of which is 36 perches, at $3\frac{1}{2}$ d. per square yard?

15. How much would a gang of men receive for excavating a trench 25 yds. 2 ft. long, 10 ft. 7 in. wide, and 8 ft. 3 in. deep, at 7s. 6d. per cubic yard?

16. What would it cost to board the walls 6 ft. high of a room which measures 24 ft. 8 in. by 17 ft. 9 in., at $8\frac{1}{2}$ d. per square foot?

17. Find the thickness of a piece of timber 12 ft. 6 in. long, 2 ft. 4 in. wide, and the solid contents $43\frac{3}{4}$ feet.

18. Ascertain the height of a room, measuring 10 ft. 6 in. long and 15 ft. wide, and containing 2475 cubic feet of air.

19. What would it cost to place a margin of paving 2 ft. wide on each side of a square court, one side being 22 ft. 6 in., at 1s. 2d. per square foot?

20. Find the value of a cube of mahogany the side of which measures 3 ft. 1 in. at 12s. 6d. per cubic foot.

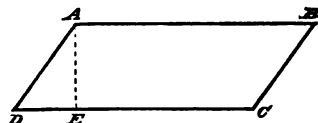
EXERCISE CCXIII.

To find the area of a rhombus, $A B C D$.

Rule.—Multiply the length by the perpendicular breadth, and the product will be the area.

Example.—Let $A B$ or $D C = 18$ ft. and $A E = 10$ ft., then $18 \times 10 = 180$ sq. ft. area.

1. What is the contents of a field in the form of a rhombus whose length is 7·6 chains and perpendicular height 5·7 chains?



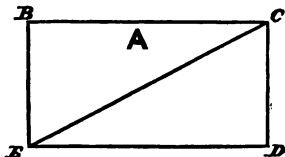
2. What is the area of a rhombus whose side is 9 ft. 6 in. and perpendicular height 7 ft. 3 in.?
3. What is the area of a rhombus whose length is 4 yds. 2 ft. and perpendicular height 11 ft. 9 in.?
4. What is the area of a courtyard in the form of a rhombus whose length is 6 yds. 1 ft. 6 in. and perpendicular width 12 ft. 9 in.?

TRIANGLES.

The rule for measuring triangles may be deduced from what has been already said about rectangles. Take the figure A, or say a sheet of paper, fold it in the line B, D , and you divide it into two equal parts, each of which is a triangle.

It is known that the area of A is found by multiplying $B C$ by $C D$; therefore, each triangle must be one-half this product.

Hence, the perpendicular $B E$ or $C D$ multiplied by the base $E D$ or $B C$, and divided by 2, will give the area of $B C D$ or $B D E$.



Example.—Let $B C$ or $D E = 8$, and $C D$ or $B E = 6$; then the area of $B C D$ or $B D E$ will be

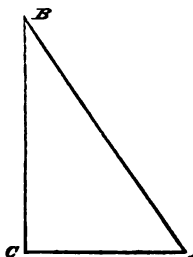
$$8 \times 6 \div 2 = 24.$$

Given any two sides of a right-angled triangle, to find the third side and thence the area.

1. To the square of the perpendicular, BC , add the square of the base, AC , and the square root of the sum will give the hypotenuse, AB .

Example.—Let the base $AC = 3$, the perpendicular $BC = 4$; required the hypotenuse, AB .

$$4^2 + 3^2 = 25, \text{ then } \sqrt{25} = 5, \\ \text{the hypotenuse } AB.$$



2. The square root of the difference of the squares of the hypotenuse and either side will give the other; or, multiply the sum of the hypotenuse and either side by their difference, and the square root of the product will give the other.

Example.—Let $AB = 5$, and $AC = 3$; required BC .

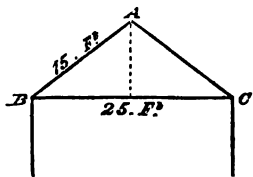
$$5^2 - 3^2 = 16; \text{ then } \sqrt{16} = 4 \text{ the side } BC; \text{ or, } (5 + 3) \times (5 - 3) = \\ 8 \times 2 = 16; \text{ then } \sqrt{16} = 4.$$

Given, $BC, 4, AC, 3$; required, the area of ABC .

EXERCISE CCXIV.

1. A ladder 50 ft. long is placed against the side of a house; the foot stands in the street 10 ft. from the house, and its top reaches the sill of the highest window; required the height of the window from the ground.

2. A factory chimney, 250 ft. high, is built on the bank of a river 40 ft. wide; what length of rope will reach from the top of the chimney to the opposite bank of the river?



3. Find the area of the gable end of a house ABC ; the side walls are 25 ft. apart, and the side of the roof measures 15 ft.

4. Required the number of yards of sail-cloth to cover the gable end of a tent; the distance from side to side is 30 ft., and the perpendicular height 36 ft.

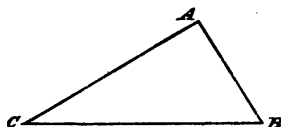
5. A ladder 40 ft. long reaches a window 21 ft. high on one side of the street, and, being changed to the other side, it reaches a window 33 ft. high ; required the width of the street.

6. Two trains start from the same station ; one travels 100 miles due west, and the other 160 miles due north ; how far are they apart when the journey is completed ?

EXERCISE CCXV.

Having the three sides of any triangle given, to find its area.

Rule.—From half the sum of the three sides subtract each side separately, multiply the half sum and the three remainders together, and the square root of the last product will be the area of the triangle.



Example.—Let $AB = 30$, $AC = 40$, $BC = 50$.

$$\frac{30 + 40 + 50}{2} = 60$$

$$60 \times (60 - 30) \times (60 - 40) \times (60 - 50) = 360000.$$

$$\text{Ans. } \sqrt{360000} = 600.$$

1. The sides of a triangular field are 4900, 5025, and 2569 links ; find the area in acres, &c.
2. What is the area of an isosceles triangle whose base is 20, and each of its equal sides 15 ?
3. How many acres are there in a triangle whose three sides are 380, 420, and 765 yards ?

To find the area of an equilateral triangle.

Rule.—Square the side, and from this square deduct its fourth part ; multiply the remainder by the fourth part of the square of the side, and the square root of the product will give the area.

Example.—Each side of a triangular field measures 4 perches.

$$4^2 = 16, \text{ then } 16 \div 4 = 4$$

$$16 - 4 = 12 ; \text{ then } 12 \times \frac{1}{4} \text{ths} = 48$$

$$\text{and } \sqrt{48} = 6.928 \text{ area.}$$

4. How many acres in a triangular field, each of whose sides measures 70 perches ?

Given the area and altitude of a triangle, to find the base.

Rule.—Divide the area by the altitude, or perpendicular, and double the quotient will be the base.

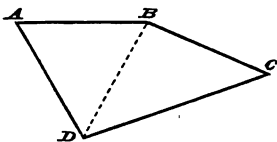
Example.—The area of a triangle is 12 yards, the altitude 4; what is its base?

$$12 \div 4 = 3$$

$$3 \times 2 = 6 \text{ yds. base.}$$

To find the area of a trapezium.

Rule.—Divide the trapezium into triangles by joining two of its opposite angles; find the area of each triangle, and the sum of both areas will be the area of the trapezium.



Example.—The five sides being given, first find the area of $\triangle ABC$, then of $\triangle ADC$, and add them together.

To find the area of an irregular polygon.

Rule.—Divide the figure into triangles and trapeziums, and find the area of each separately; add these areas together, and the sum will be the area of the polygon.

CIRCLES.

To find the area of a circle.

1. Multiply half the circumference by half the diameter.

Example.—Find the area of a circle whose diameter is 100 and circumference 314.16.

$$\text{Ans. } \frac{314.16}{2} \times \frac{100}{2} = 7854.$$

2. Multiply the square of the diameter by .7854 for the area.
3. Multiply the square of the circumference by .07958.
4. As 14 : 11, so is the square of the diameter to the area.
5. As 88 : 7, so is the square of the circumference to the area.

EXERCISE CCXVI.

1. A cord $39\frac{1}{2}$ yards long was fastened by one end to a stake in the centre of a field and the other end to the horns of a cow ; what area of grass was allowed for the cow ?

2. What is the area of a semicircular piece of water, the radius of which is $7\frac{1}{2}$?

3. What is the area of a carriage drive, 12 feet wide from the hedge of a circular park, the diameter of which is 1 furlong ?

4. Having a lawn an acre in extent, I wish to make a circular fish-pond in the centre, which shall take up only half the lawn ; required the diameter.

5. I wish to stake off a circular estate in a common ; starting from the centre I mark off 60 yards for house, gardens, and lawns, then 4 yards for carriage-drive, and 36 yards more for trees, shrubs, &c. ; required the area of the whole ?

6. The circumference of a round table is 18.85 ft. ; find the area.

EXERCISE CCXVII.

1. A piece of timber 15 inches square at each end, and 18 ft. long, is to be measured ; find its contents, and how far from the end must it be cut across so that the piece cut off may contain one solid foot ?

2. A cellar is to be dug whose length, breadth, and depth are 11 ft. 6 in., 12 ft. 4 in., 9 ft. 8 in. ; required the number of solid feet.

3. The site for a house and garden is 40 yds. 2 ft. by 20 ft. 6 in. ; the house is to cover one-third ; find the area of each.

4. In a house of sixteen rooms are front and back doors, each measuring 7 ft. 6 in. by 3 ft. 2 in., two cupboard-doors in each room, 4 ft. 1 in. by 2 ft. 9 in., and each room-door is 7 ft. 2 in. by 3 ft. ; find the quantity of timber in all the doors.

5. A room containing 27000 cubic feet of air is 30 ft. wide and half as high ; required its length.

6. I wish to cover the centre of a room with carpet, $\frac{3}{4}$ of a yard wide, at 4s. 6d. per yard ; how much of the room can I cover for £10 16s. 3d. ?

EXERCISE CCXVIII.

1. A square garden is enclosed by four walls ; find the length of the four walls, and the cost of building, at 17s. 6d. per running yard, and the area of the garden in acres, when one side is 210 feet long ?

2. A garden measuring 3 acres has a circular pond in the centre, 100 yards across ; find the area left for cultivation.

3. A book consists of 100 printed leaves, each measuring $6\frac{1}{2}$ inches by $4\frac{1}{2}$ inches ; find the whole surface of printed matter if a margin of $\frac{1}{2}$ an inch is left all round ?

4. To find the area of a triangle you multiply the length of the base by half the perpendicular height. The base of one is 101 yds. 2 ft., and area 1000 yards ; what is the perpendicular height ?

5. The area of the kingdom of Portugal is 37000 square miles ; express this in acres. If the waste land has an area of 23680 acres, find the proportion of waste to cultivated land.

6. A schoolroom measures 90 ft. 6 in. by 43 ft. 4 in. ; if each pupil require 8 square feet, find the number of pupils it will accommodate ?

7. A carpenter has two boards an inch thick, each 9 feet long, 15 inches wide ; out of it he makes a box 2 ft. 6 in. long, 1 ft. 4 in. deep, and 18 in. wide ; find how much material is wasted ?

8. A piece of grass measures 343 ft. by 103 ft. ; on it is built a house, &c., occupying a space = to 23 ft. 4 in. by 93 ft. 3 in. ; in front are three circular flower-beds, 16, 12, and 10 ft. respectively in diameter, and behind, the garden, 180 ft. long, by 103 wide ; how much remains in grass ?

9. A linen chest has in it four drawers, each 5 ft. by 2 ft. 4 in. by 1 ft., and 2 measuring 2 ft. 3 in. by 2 ft. 4 in. by 6 in. deep ; find the whole space for keeping linen.

EXERCISE CCXIX.

1. A schoolroom is built for 300 children, allowing 8 sq. ft. to a child ; the length is 84 ft. ; what is the breadth ?

2. A rectangular garden is 40 yds. long by 35 yds. wide ; it has a circular piece of grass in the centre 30 ft. in diameter, with a gravel-walk round the grass 6 ft. wide ; find the area of the gravel-walk and the part of the garden outside it.

3. A water-wheel is 10 ft. 9 in. in radius ; find its circumference and its diameter.

4. A carriage-wheel is 4 ft. 6 in. in diameter ; how many times will it turn in going from Plymouth to Exeter, a distance of 54 miles ?

5. A room is 60 ft. long, 18 ft. 5 in. broad, and 17 ft. 6 in. high ; how many boxes will it hold, each box being 3 ft. 2 in. \times 1 ft. 5 in. \times 1 ft. 4 in. ?

6. A fish-pond has a fountain in the centre, and a rod 12 ft. 6 in. long will reach from the edge to the centre ; the pond is 4 ft. 9 in. deep ; how much water will it contain when full, supposing a cubic foot of water to weigh 1000 oz. ?

EXERCISE CCXX.

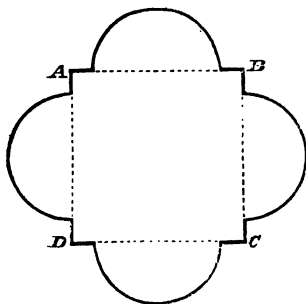
1. A room is 30 ft. wide, the pitch of the roof is $\frac{1}{3}$ rd of the width, and the wall is 30 ft. from the ground to the ridge, and 2 ft. 6 in. thick ; how many cubic ft. will the gable end contain ?

2. Find the cost of glazing a circular window 5 ft. 9 in. diameter, with glass at 1s. 6d. per sq. ft.

3. Wishing to sink a circular well 5 ft. wide in my garden, I engaged a man to do it at 6s. per cubic yd. ; he had to sink 80 ft. ; what did it cost me ?

4. Two velocipedes have their driving-wheels of 5 ft. and 4 ft. 6 in. in diameter respectively ; supposing that they have both made the same number of revolutions (500), how far will one be ahead of the other ?

5. Whilst looking at a flag-pole and wondering what its height was, a blast of wind broke it, the upper part hanging to the lower, but with its top on the ground, 15 ft. from the pole; after being in this position for a few minutes the broken piece fell, and I found it to be 31 ft. 6 in. long; what was the length of the pole before being broken?



6. A, B, C, D, is a croquet-ground 240 sq. ft. 36 sq. in., having four semicircular flower-beds 9 ft. 6 in.

in diameter; find the area of the beds and one side of the croquet-ground.

GENERAL INFORMATION.

The circumference of a circle equals the diameter multiplied by 3·1416, the diameter.

The radius of a circle equals the circumference multiplied by ·159155.

The radius of a circle equals the square root of the area multiplied by ·56419.

The diameter of a circle equals the circumference multiplied by ·31831.

The diameter of a circle equals the square root of the area multiplied by 1·12838.

The side of an inscribed equilateral triangle equals the diameter of the circle multiplied by ·86.

The side of an inscribed square equals the diameter of a circle multiplied by ·7071.

The side of an inscribed square equals the circumference of the circle multiplied by ·225.

The circumference of a circle multiplied by ·282 equals one side of a square of the same area.

The side of a square equals the diameter of a circle of the same area multiplied by $\cdot 8862$.

The area of an ellipse equals the product of both diameters and $\cdot 7854$.

The solidity of a sphere equals its surface multiplied by one-sixth its diameter.

The surface equals the product of the diameter and circumference.

The surface of a sphere equals the square of the diameter multiplied by $3\cdot 1416$.

The surface equals the square of the circumference multiplied by $\cdot 3183$.

The solidity of a sphere equals the cube of the diameter multiplied by $\cdot 5236$.

The diameter of a sphere equals the square root of the surface multiplied by $\cdot 56419$.

The square root of the surface of a sphere multiplied by $1\cdot 772454$ equals the circumference.

The diameter of a sphere equals the cube root of its solidity multiplied by $1\cdot 2407$.

The circumference of a sphere equals the cube root of its solidity multiplied by $3\cdot 8978$.

The side of an inscribed cube equals the radius multiplied by $1\cdot 1547$.

The solidity of a cone or pyramid equals the area of its base multiplied by one-third of its altitude.

SEVENTH PART.

COMPOUND ADDITION.

IN most examinations conducted by the Civil Service Commissioners "Separate Addition" papers are given, containing twelve such sums as the following, to be worked in half an hour, for which fifty marks are allowed ; it is therefore important that all candidates preparing for such examinations should familiarise themselves with this kind of work. An excellent little work by Dr. Evers, published by Collins and Son, at 6d., will be found very useful for this purpose.

EXERCISE CCXXI.

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	2467	18	6	(2)	7921	12	6	(3)	5841	18	7
	892	9	9		1534	3	9		394	11	5
	79	14	4		4168	14	5		182	6	9
	4186	13	11		871	19	7		6014	13	2
	9235	16	9		5216	4	11		962	19	9
	1768	11	7		9104	16	3		1628	6	3
	84	17	6		419	5	2		3004	9	6
	7016	9	8		3471	15	7		4169	16	7
	8423	12	10		523	13	9		5241	2	9
	2167	5	3		6741	6	5		4143	1	11
	6821	19	7		3128	11	7		8456	10	6
	2149	6	2		610	13	1		97	6	3
	3598	18	4		4197	7	6		8	14	6
	205	1	8		326	16	5		6791	18	5
	1576	14	6		1984	2	10		986	4	7
	4231	9	11		8213	14	2		1028	16	9
	6157	4	3		5432	6	1		4671	11	4
	2516	13	2		6101	17	3		3124	9	3
	3561	8	1		2046	6	4		4961	13	5
	8672	16	4		7162	18	5		1246	18	9
	128	12	8		3491	2	4		567	13	4
	91	13	6		862	14	8		4018	6	8

£	s.	d.	£	s.	d.	£	s.	d.
(4) 7371	17	4	(5) 5981	14	6	(6) 2346	16	6
1658	14	2	2546	18	4	5614	13	7
4919	19	3	9714	16	9	8668	19	8
3636	16	6	4256	13	4	9721	6	5
4515	12	9	1842	18	8	6148	17	7
2714	13	3	7235	15	9	7914	14	6
1458	11	2	4186	16	5	645	15	5
6242	8	10	6776	17	7	6184	19	7
5416	16	8	5440	10	11	3553	13	3
7575	15	5	8334	14	4	4197	14	9
2421	13	4	16551	9	2	5671	13	6
9419	9	7	8342	16	5	8216	14	7
8653	14	2	7184	13	7	6428	16	9
2518	18	8	5617	17	4	8442	12	2
3864	16	7	1452	18	6	3535	13	3
4128	15	5	6767	11	1	8668	18	8
7914	16	6	1818	14	3	2151	15	5
526	18	9	7262	11	5	7227	17	7
6142	7	4	6418	12	2	4645	13	3
5665	15	3	8146	16	6	1862	11	2
4774	14	6	4012	14	4	987	10	8
65167	18	8	6784	12	2	7164	13	7

EXERCISE CCXXII.

£	s.	d.	£	s.	d.	£	s.	d.
(1) 7575	15	5	(2) 4242	12	2	(3) 5234	13	9
1246	18	8	3179	11	8	891	19	6
16158	17	7	164	9	9	6164	14	4
5671	14	4	8564	18	7	5421	13	8
5252	13	3	976	14	4	6165	15	9
34343	12	8	1679	12	2	5472	12	4
7575	15	6	2561	13	8	4106	16	6
986	16	9	4618	12	9	7981	11	4
1212	13	11	2179	13	4	5656	16	6
586	12	2	1616	6	3	4102	9	7
4164	14	4	7373	13	5	8625	15	5
9292	19	1	4817	17	7	5824	13	3
1618	18	8	5616	16	6	1643	11	9
4375	15	5	9254	14	4	2468	18	8
18251	14	4	4343	13	3	6321	12	4
986	16	6	6565	15	5	8517	16	6
1243	9	1	9019	18	8	146	17	7
6152	13	2	8601	9	1	6854	18	4
746	15	7	4196	14	11	4019	15	3
5412	9	9	2561	13	9	2563	16	6
6821	16	6	896	15	6	5187	17	7
934	8	7	7152	16	4	2564	9	11

BARTER'S

	£	s.	d.		£	s.	d.		£	s.	d.
(4)	1243	16	6	(5)	3614	18	8	(6)	2579	19	11
	6791	14	1		768	16	9		915	13	2
	6419	19	9		1617	9	10		1716	6	8
	12345	15	5		7421	18	6		4684	18	6
	8671	12	2		316	14	4		1717	17	7
	2465	16	8		12467	13	2		4691	16	2
	1919	9	9		1964	11	9		2163	14	4
	2424	14	4		9146	12	2		5432	12	3
	1313	13	3		403	10	11		2387	19	9
	5454	15	5		6917	17	7		1818	8	8
	1616	16	6		1465	15	6		7161	13	5
	6161	12	2		7614	13	4		25651	18	11
	827	17	7		8161	12	9		8765	4	3
	12371	14	6		570	14	2		5642	11	4
	982	12	2		1694	11	1		3825	15	5
	32561	8	8		8271	9	8		910	19	9
	523	11	1		4568	18	6		1643	12	2
	8674	13	3		976	16	1		7164	13	4
	1828	18	8		4168	17	7		281	17	6
	2546	16	5		5617	14	9		6267	13	3
	602	12	7		4169	13	6		5816	14	4
	7145	15	5		8210	14	2		168	9	5

EXERCISE CCXXIII.

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	32514	13	9	(2)	2346	12	3	(3)	6231	18	4
	8251	17	2		517	18	7		867	13	9
	1524	18	6		4197	16	9		2461	12	2
	6717	16	9		8642	13	4		184	13	1
	3248	11	10		1013	12	6		61475	18	8
	5764	15	8		4626	18	9		647	17	7
	6126	9	7		11132	11	10		8246	16	6
	7401	14	6		8765	15	4		13603	13	5
	8257	12	5		2303	14	5		9642	12	2
	4016	8	11		5656	16	6		2514	18	8
	8627	16	4		21212	12	2		7862	14	6
	5410	7	6		743	13	4		6410	11	3
	9126	18	2		9164	18	9		2167	17	4
	1456	16	9		216	13	10		8532	12	11
	2130	2	4		3862	9	2		2146	16	9
	7254	16	8		1218	13	11		1830	2	7
	15151	15	5		3586	17	6		8133	13	3
	3434	14	1		4212	6	5		6512	11	2
	1818	6	2		7104	12	3		1246	15	5
	2424	13	7		417	13	6		812	9	7
	152	15	9		26542	18	9		1246	12	4
	8546	17	2		716	4	3		617	17	6

	£	s.	d.		£	s.	d.		£	s.	d.
(4)	2624	17	7	(5)	7242	13	9	(6)	3461	13	6
	8181	18	8		4158	16	11		2513	19	10
	919	9	9		5161	16	6		5678	13	4
	6142	16	3		1717	17	7		2514	12	2
	1618	13	11		8484	14	4		4167	15	3
	2461	15	9		12	13	3		2525	13	4
	826	13	6		6241	6	9		917	18	8
	1318	9	8		3184	11	10		2152	13	9
	6123	18	6		8469	19	9		5454	14	4
	768	4	11		3812	12	2		356	18	2
	8235	16	6		5272	13	8		2132	7	6
	6016	15	5		184	16	9		4617	18	2
	9824	14	7		8625	17	4		4212	13	11
	961	13	6		4019	8	6		6715	12	6
	6142	19	4		5616	19	2		3192	14	3
	7074	2	8		194	11	1		4521	10	2
	152	17	7		8641	10	4		1218	8	11
	6849	13	6		1918	13	5		461	12	3
	921	14	2		642	16	4		5168	17	5
	1694	11	10		4018	13	3		16741	18	6
	8618	3	6		81674	14	9		4121	2	9
	5210	14	2		126	11	10		614	19	7

EXERCISE CCXXIV.

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	2584	16	2	(2)	5454	11	10	(3)	3636	16	4
	4197	6	11		3535	15	5		857	18	5
	864	18	6		18	18	8		4169	11	10
	1640	10	10		846	16	11		8625	18	11
	6060	13	9		1818	9	4		158	3	2
	7198	18	8		4251	16	8		6421	18	5
	8461	12	3		6123	14	9		4198	13	7
	1385	11	2		8247	18	6		620	10	1
	5671	13	5		986	13	11		1652	15	6
	716	9	4		19	19	9		6146	16	4
	8181	16	8		7148	6	4		253	19	5
	932	13	6		9231	14	7		5184	14	8
	1648	16	3		5353	13	3		1548	17	9
	8601	11	5		1616	16	6		192	8	6
	984	14	4		5757	17	7		9124	16	3
	3461	9	8		9393	13	3		852	13	9
	7168	16	11		825	16	10		6174	2	3
	764	6	9		6434	10	6		1417	17	7
	1846	13	10		9841	13	9		6251	18	5
	4623	14	6		3168	14	3		8181	9	3
	48	17	5		8621	12	6		52	11	4
	761	18	9		418	9	7		5617	18	6

	£	s.	d.		£	s.	d.		£	s.	d.
(4)	7325	18	7	(5)	5675	15	5	(6)	3535	13	9
	682	6	11		4157	17	7		8614	16	6
	6185	19	10		6234	14	4		152	18	4
	9040	16	3		1616	16	6		6784	15	9
	6152	18	4		4258	18	8		7168	13	11
	7046	16	9		1919	19	9		9214	14	3
	9743	15	3		9462	8	6		3529	12	4
	987	9	11		251	16	5		4146	17	6
	6891	13	4		1618	13	2		3681	8	9
	1264	8	6		6425	8	9		6154	11	11
	6652	13	7		6161	13	11		3478	9	1
	7272	12	10		894	2	6		1513	10	6
	4646	6	3		1716	16	8		678	11	3
	5217	8	8		3457	12	3		6513	15	4
	6452	16	6		1652	8	4		7474	14	8
	2358	12	2		6426	11	2		5252	11	6
	4136	8	5		184	6	1		684	19	1
	5252	13	2		8168	19	11		2416	8	7
	1798	12	6		2153	4	9		821	13	4
	7189	16	4		1864	17	6		4165	12	5
	4016	13	11		4689	6	5		8251	16	4
	2652	4	7		5246	13	9		1416	18	11

EXERCISE CCXXV.

	£	s.	d.		£	s.	d.		£	s.	d.
1)	1356	16	4	(2)	2346	18	2	(3)	3286	16	4
	4182	9	8		1069	14	6		6143	12	8
	8764	14	5		825	17	8		7341	18	6
	4186	16	9		2384	6	9		7616	8	5
	8604	12	8		1801	19	11		4242	12	7
	1823	16	6		946	16	3		6565	8	9
	6254	8	4		4902	4	10		910	17	6
	5891	16	8		6784	19	2		1976	13	8
	4068	4	7		1652	13	4		9167	11	6
	824	12	11		7625	3	7		6193	4	3
	1615	3	10		1764	14	9		7921	18	2
	5860	17	2		2468	13	8		1616	13	1
	1453	4	5		3123	17	7		847	15	7
	6272	13	7		8576	8	4		4016	14	10
	6056	5	9		3461	19	7		8064	18	2
	743	11	4		1953	14	9		1652	14	1
	5168	7	5		3467	13	5		5246	13	5
	7682	12	8		98	6	6		1952	17	9
	826	18	6		143	18	11		2341	6	10
	4182	16	2		5684	15	2		7416	8	11
	5610	9	11		4165	6	3		9123	13	4
	6151	3	6		2582	11	6		257	19	8

	£	s.	d.		£	s.	d.		£	s.	d.
(4)	34781	18	4	(5)	5161	18	9	(6)	34610	16	8
	5614	16	7		7145	16	10		8514	14	4
	987	13	6		861	19	9		3131	13	3
	19154	10	9		7128	14	4		8641	18	8
	3416	18	11		18546	12	2		7171	19	7
	1717	16	6		2102	17	6		987	15	5
	8686	17	4		4607	16	8		1461	13	6
	419	12	3		6512	14	11		3472	16	3
	8342	13	2		7647	8	6		4726	13	9
	1815	11	8		416	13	3		9142	9	10
	6310	18	10		8910	16	4		12564	11	4
	5218	13	3		4186	13	6		4152	19	1
	6234	4	9		51231	12	8		9456	16	6
	1716	8	11		3817	18	4		1245	15	5
	489	19	6		124	6	2		3196	8	8
	8416	4	1		5471	19	1		6248	11	3
	17251	18	6		4167	17	7		914	14	4
	634	7	7		8234	15	5		1628	16	2
	9169	8	4		3125	13	4		6143	13	3
	8641	17	9		413	11	2		816	16	6
	7158	4	10		5162	13	8		6164	10	9
	6246	18	6		1616	10	9		8146	11	6

EXERCISE CCXXVI.

	£	s.	d.		£	s.	d.
(1)	2525	13	4	(2)	2161	16	5
	7630	14	2		8476	13	7
	9252	13	7		9761	19	10
	8647	17	6		6184	14	4
	1236	12	3		2571	12	8
	3643	16	9		5867	13	5
	4215	11	10		4538	11	9
	6702	19	2		2764	16	6
	168	18	3		1416	17	7
	25252	17	5		7232	12	2
	8768	16	11		9619	10	11
	47641	15	1		4256	16	2
	7425	14	4		152	15	6
	9856	13	6		1846	13	3
	1097	12	7		9124	14	4
	4623	11	3		6348	18	8
	7146	10	4		3251	17	3
	6728	9	7		5764	12	2
	2525	8	8		23450	10	6
	7642	7	9		783	13	7
	3131	6	1		2562	12	5
	2525	5	10		4618	14	3

	£	s.	d.		£	s.	d.		£	s.	d.
(3)	5467	16	4	(4)	2346	16	2	(5)	3516	13	8
	6871	17	1		1417	13	1		8616	14	9
	14619	10	11		16161	14	6		2545	15	5
	768	18	9		5247	17	7		6818	18	8
	4176	16	1		8761	14	8		1425	14	7
	7643	13	2		42618	12	11		2561	12	4
	3164	15	5		5245	15	4		1857	13	3
	35238	18	8		1518	11	2		2641	17	6
	1846	16	6		2342	19	9		1246	15	2
	6253	13	3		6715	13	3		8975	16	3
	2561	19	1		2641	10	2		2649	13	4
	5246	11	10		5104	8	1		4168	11	9
	8681	8	9		2479	16	6		5214	19	8
	2246	16	6		8312	7	4		8383	12	10
	3434	13	3		4781	12	5		5252	14	6
	4545	14	4		2626	13	7		7014	16	11
	16767	16	2		1313	14	9		9521	13	5
	2183	10	11		3652	11	2		1418	18	7
	5656	18	8		4259	16	3		7684	14	4
	12424	11	1		7481	9	6		972	12	2
	6253	13	3		6124	15	5		6146	17	1
	1767	17	4		8585	13	2		892	13	6

	£	s.	d.		£	s.	d.		£	s.	d.
(6)	2316	18	9	(7)	9862	11	2	(8)	2367	17	6
	1612	16	10		1618	14	3		897	14	4
	42564	17	9		2354	13	5		6714	13	3
	6158	13	11		8787	17	7		6142	15	6
	8256	19	10		1616	16	6		8617	17	4
	419	13	8		5353	12	2		3461	11	9
	7984	14	6		4018	11	4		579	19	6
	1615	15	5		19617	10	9		2164	16	4
	3426	16	3		5426	18	8		8641	13	3
	6851	11	4		6234	14	4		762	15	7
	76164	12	2		8326	16	6		5216	16	4
	8243	13	3		6183	10	11		6425	17	7
	2152	14	4		23461	13	3		23467	13	3
	3425	2	9		1717	17	7		9786	16	6
	2163	12	6		8484	14	4		712	12	2
	34253	13	5		4136	9	10		1256	15	5
	8617	17	7		12345	15	5		5641	13	4
	86	11	10		5621	14	3		2719	8	7
	425	19	1		6452	9	7		5276	16	11
	4176	8	2		1789	13	1		14561	7	10
	5291	12	6		2165	14	8		6842	15	5
	1614	11	5		3424	15	5		2571	9	1

EXERCISE CCXXVII.

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	8154	16	6	(2)	9104	13	8	(3)	34781	14	2
	7145	15	3		4167	14	6		9617	13	6
	9040	14	11		5676	13	7		4128	17	7
	1527	7	9		5555	15	5		2561	15	8
	7426	18	8		2789	19	9		5125	10	11
	9610	14	4		2124	11	10		7891	12	9
	1247	17	7		6060	17	2		6165	14	6
	2605	13	6		4196	9	3		8214	11	5
	8914	12	4		5241	12	5		25146	13	3
	4176	15	2		7165	14	4		6871	12	9
	8654	13	4		9462	11	9		4167	17	6
	6401	9	3		8321	13	10		3406	16	5
	12536	16	6		7564	19	8		2121	11	7
	6195	13	7		3146	16	2		589	18	8
	3333	19	8		897	14	3		4242	12	2
	1764	11	9		6152	15	5		1654	14	4
	4650	17	1		571	11	4		6513	13	3
	9898	18	6		3152	18	8		7152	10	9
	4444	14	4		4534	12	2		12345	15	5
	7676	12	2		3018	15	1		2561	19	4
	5252	15	8		6565	13	3		143	13	2
	8624	12	1		17164	14	4		6784	14	7
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	£	s.	d.		£	s.	d.		£	s.	d.
(4)	3461	17	7	(5)	2151	13	9	(6)	2578	12	11
	1716	14	8		9864	14	6		5641	14	6
	4545	15	5		42352	12	4		2564	16	5
	3636	16	6		1765	10	11		25617	18	8
	24747	17	7		6764	14	5		8916	16	6
	8181	18	8		1517	17	6		4565	15	5
	3534	13	3		7162	12	4		1234	14	4
	6716	16	6		2514	14	6		8681	18	8
	7689	10	9		652	18	8		2134	14	4
	8124	14	4		1753	13	3		3762	12	2
	2561	11	9		5214	14	5		5215	15	5
	1645	13	10		897	11	7		879	19	9
	7891	12	7		1234	12	11		1245	10	11
	316	18	8		1618	19	9		6789	18	8
	2567	17	4		4256	16	6		4016	16	6
	6412	12	3		2161	11	1		5647	13	3
	3658	9	6		4343	13	2		13465	15	9
	1716	14	2		5348	18	8		1630	17	7
	3425	15	6		9216	17	7		8467	10	11
	168	17	4		8351	16	6		2571	9	3
	4267	13	3		7835	15	5		1256	16	6
	5113	10	1		1462	12	2		924	13	9

EXERCISE CCXXVIII.

£	s.	d.	£	s.	d.	£	s.	d.
(1) 2482	14	6	(2) 5456	12	1	(3) 6410	15	7
7106	12	2	1652	18	7	8686	14	4
42391	13	9	4896	13	3	1515	15	5
4242	8	6	8484	14	4	2617	13	2
6210	17	4	9191	19	9	7168	11	1
896	16	7	1616	16	6	9846	12	4
1248	11	2	3535	13	3	3617	13	8
6742	15	5	16194	15	5	1832	17	11
5213	14	8	2351	11	9	24367	12	9
6781	12	2	1462	12	10	2425	13	7
1342	10	1	7381	18	8	216	9	9
589	19	9	5416	17	7	8671	14	4
2318	6	2	1875	13	4	436	17	8
4545	18	6	6943	14	5	25678	13	5
1983	2	11	2610	10	2	5165	15	5
6745	17	4	8163	17	1	2304	19	7
3852	12	5	5821	12	7	8216	16	6
537	10	3	615	15	11	9167	11	2
16148	16	8	1861	10	6	5215	8	8
8641	17	5	924	13	3	1426	13	3
1843	5	2	12345	11	2	2423	16	6
257	16	4	1986	18	1	518	17	7
<hr/>			<hr/>			<hr/>		
£	s.	d.	£	s.	d.	£	s.	d.
(4) 8775	13	4	(5) 4579	18	7	(6) 2564	18	3
2554	15	8	2614	14	4	8621	14	9
6117	14	7	8443	13	3	2446	19	11
7224	15	5	19645	18	8	5662	14	4
4668	18	8	1658	10	9	1616	16	6
6479	19	9	4579	19	4	7894	13	3
2143	10	11	4117	17	7	5312	16	1
3412	12	6	5668	13	3	6185	18	11
1674	13	5	4226	9	11	2423	11	9
7432	17	7	8374	14	4	4716	6	6
1448	4	2	25251	16	6	5234	14	4
6779	19	9	1845	11	9	36363	13	3
7615	16	6	6425	15	5	4791	16	5
9446	13	3	2418	9	10	6419	17	7
7619	14	5	6897	16	7	7461	18	9
8465	15	7	1234	14	4	3718	14	10
1618	7	9	5612	13	3	5758	13	8
7485	16	6	8241	18	8	7164	9	1
217	18	8	7165	15	2	5864	10	11
5643	15	5	9426	17	7	4618	14	6
7914	17	1	1768	8	4	8254	16	8
1765	6	8	4239	17	9	4318	10	9

EIGHTH PART.

SPECIMEN EXAMINATION PAPERS.

EXERCISE CCXXIX.

Training College Examination for Pupil Teachers.

1. Find by practice the cost of 609 articles, at £7 18s. 9½d. each.
2. If the rent of 39 a. 2 r. 20 pls. is £148 11s. 10½d., what will be the rent of 42 a. 1 r. ?
3. If a boy's wages for one year be £23 10s., what will it be for 7 years 8 calendar months 16 days (reckoning 30 days to the month) ?
4. A rabbit is worth 8½d., a hare 3s. 6½d.; how many scores of rabbits would be equal in worth to 13½ dozen hares ?
5. When wheat is 37s. 6d. per quarter, what should I get 5 bushels for ?
6. If a box 2 ft. square and 3 ft. deep contain 100 oranges, how many should be in one 2 ft. long, 3 ft. broad, and 7 ft. deep ?
7. A household of 14 persons spend £35 15s. in six weeks; at the same rate what should maintain a household of 18 persons for a quarter of a year ?
8. If the 4d. loaf weigh 72 oz. when wheat cost 77s. for a quarter, what should the 3d. loaf weigh when wheat is 81s. per quarter ?
9. A. B. sells a pig to a neighbour for 19s. 3d., gaining thereby 12 per cent. on what he gave for it; how much did he give ?
10. At what rate per cent. simple interest will £112 10s. amount to £128 5s. in 4 years ?

11. A, B, C, having a joint capital of £10000, buy, with 93 per cent. of it, a ship and her cargo; the latter being worth two-thirds of the former. The ship is lost, the cargo saved. What amount per cent. on his own capital does each partner lose?

12. I was entrusted with £100, and directed to pay out of it £49 13s. 9d., retaining as my remuneration the difference between 8 and 8 per cent. on the remainder; how much did I receive for my services?

13. A clock goes at the rate of .08 per cent. too fast for 9 months, is reset, and loses at the same rate for 3 months; how much will it have gained or lost at the end of a year of 365 days?

14. In what time will £2675 4s. 2d. amount to £3036 7s. 2½d., at six per cent. simple interest; and what sum would it have amounted to at compound interest in the same time?

15. A capitalist invests £5187 10s. in the 3 per Cents at 83; he transfers three-fifths of this sum to the 4 per Cents at 96; find the alteration in his income.

EXERCISE CCXXX.

1. Find the cost of 11 tons 17 cwt. 1 qr. 19 lbs., at £7 per ton.
What is the value of 10 lbs. 11 oz. 16 dwts. 16 grs. of gold, at £3 17s. 10½d. per oz.?

2. If it costs £1 14s. 5d. to mow a field of 3½ acres, what must be paid for mowing 45 a. 3 r. 20 p.?

3. If either 5 oxen or 7 horses eat up the grass of a field in 87 days, in what time will two oxen and 3 horses eat it up?

4. Find the value of 947 articles, at £4 15s. 10½d. each.

23 cwt. 3 qrs. 8 lbs., at £3 19s. 11d. per cwt.

5. Divide 1406373 by 108.

Divide £5289 3s. 1½d. by 582.

6. What is the difference between a roll of silk which measures 154 yards, and 3 rolls measuring 17½ yards each? and what do all measure together?

7. If a person were to count 80 sovereigns per minute, and con-

tinue counting 12 hours a day, how many days would he be occupied counting a million ?

Make out a bill for $\frac{3}{4}$ lb. of butter, at 1s. 3d. per lb. ; $3\frac{1}{4}$ lbs. of candles, at 9d. per lb. ; $1\frac{1}{4}$ lbs. of coffee, at 1s. 6d. per lb. ; $\frac{1}{2}$ lb. of tea, at 3s. 10d. per lb.

8. Express as vulgar fractions in their lowest terms $\cdot 365$, $\cdot 125$, $\cdot 0035$, $\cdot 012$, $11\cdot 94$, and $8\cdot 06$.

9. Add $\frac{2}{18}$ ths at 1s. 6d. to $\frac{23}{90}$ ths of 10s., and subtract from their sum $\frac{2}{3}$ ths of 12s. 6d.

10. Find the value of $2\cdot 86805$ of 3s. + $\cdot 83$ of 4s. + $1\cdot 8$ of 5s., and subtract it from a guinea.

11. If $2\frac{1}{2}$ bushels can be got for $\frac{2+\frac{1}{3}}{3+\frac{1}{2}}$ of £1, what should be the cost of $793\frac{1}{8}$ bushels ?

How many yards of matting 2ft. 6 in. broad will cover a floor that is 27 feet long and 20 ft. broad ?

12. If a family of 9 people spend £120 in 8 months, how much will serve a family of 24 people 16 months ?

13. If 2 men can do $12\frac{3}{4}$ rods of work in $6\frac{1}{2}$ days, how many rods may be done by 18 men in 14 days ?

14. What amount of capital, put out at $3\frac{1}{2}$ per cent. per annum, simple interest, would produce £14 interest in $2\frac{1}{3}$ rd years ?

15. A flask contains three quarters brandy and one quarter water ; the owner drinks half of its contents, and then fills up the flask with water ; he then drinks half again, and again fills up with water. What is the percentage of the brandy, and what is that of the water after each dilution ?

16. If the sum of £1200 be put out at ten per cent. per annum, compound interest, paid half-yearly, what will it amount to in $1\frac{1}{2}$ years ?

EXERCISE CCXXXI.

1. Find the greatest common measure of 918, 1928, and 522.
2. What is the value of $\frac{7}{8}$ ths of a cwt. ?
3. Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together.

4. A man bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{1}{2}$ yards, at 6s. 0 $\frac{1}{2}$ d. per yard; what does the whole come to?

5. At what rate per cent. per annum, simple interest, will £776 15s. amount to £978 14s. 1 $\frac{1}{2}$ d. in $6\frac{1}{2}$ years?

6. A merchant buys some tea at 2s. 3d. per lb. and some at 3s. 6d.; in what proportion must he mix them so that by selling the mixture at 4s. a lb. he may realise 20 per cent.?

7. A tea-dealer buys a damaged cargo for £530, and after spending 7 per cent. on the cost price in preparing it for the market, he sells it at 120 per cent. profit, receiving for it the same gross sum as is received by another dealer, who purchased a sound cargo, and sells it for 32 per cent. profit. Find the value of the sound cargo.

8. Divide 14 by .7854.

9. Reduce 17 yds. 1 ft. 6 in. to the decimal of 1 mile.

10. Find the sum of the following: £927, £350, £203, £061, £020, and £009.

11. If a tradesman, by selling an article at 8s. 3d. loses $17\frac{1}{2}$ per cent., what should he have sold it for to gain 40 per cent.?

12. A general contracted to pay £5458 for 13633 pairs of boots and shoes for his army; the price of each pair of shoes was to that of each pair of boots as 5 to 8, but the number of the pairs of shoes was to the number of the pair of boots as 2 to 1; give the numbers and prices respectively of the pairs of boots and shoes.

13. If the ton be diminished 10·714285 per cent., and the ounce avoirdupois be increased 25 per cent., how many lbs. would there be in a ton?

EXERCISE CCXXXII.

1. Add together the following numbers: Twenty millions, twenty thousand, and twenty, nineteen thousand and thirty-seven, two hundred and seven thousand, five hundred, seven millions, three hundred and nine, ten thousand and one.

2. What number multiplied by 64 will give the same product as 864 multiplied by 408?

3. If a piece of cloth measuring $7\frac{1}{2}$ yards cost £8 6s. 3d., what is the value of a piece containing $19\frac{3}{4}$ yards?

4. A grocer bought 6 hogsheads of sugar each weighing 3 cwts. 2 qrs., and sold to A $17\frac{1}{2}$ lbs., B $1\frac{1}{2}$ cwt., C 1 cwt. 2 qrs. 8 lbs., and to D. 1 qr. 18 lbs.; how much had he left?

5. Find the number of square yards contained in a field of 14 a. 3 r. 35 pls.

6. Find the number of farthings in 263 guineas, 116 sovereigns, 304 crowns, 190 florins, and 529 shillings.

7. How many parcels of 4 lbs. 5 oz., 3 lbs. 9 oz., and 6 lbs. 14 oz., and of each an equal number, can be made up from 2 cwts. 3 qrs. 7 lbs. 4 oz.?

8. Make an invoice of the following: $18\frac{1}{2}$ yards of calico, at 7d. per yard; 11 yards of muslin, at 15d.; $4\frac{1}{2}$ yards of diaper, at 1s. 9d.; $7\frac{1}{4}$ yards of brown holland, at 11d.; and 15 yards of flannel, at 1s. 7d.

9. What will be the amount of a poor-rate at 1s. 7d. in the pound on 327 a. 2 r. 20 p. of land, rated at 2 guineas per acre?

10. A gentleman gave £2 to be divided among his three nephews, Jones, Smith, and Robinson, in proportion to their ages, which were $12\frac{3}{4}$, $9\frac{1}{2}$, and $7\frac{1}{2}$ years; find their respective shares.

11. If 12 men, working $10\frac{1}{2}$ hours per day, earn 21 guineas in 7 days, in how many days will 10 men, working 9 hours a day, earn £27?

12. Calculate by practice: 19 cwts. 2 qrs. $26\frac{1}{2}$ lbs., at £5 10s. 6d. per cwt.

13. Subtract $\frac{3}{8}$ ths of $\frac{9}{12}$ ths of a half-crown from $\frac{1}{8}$ ths of a half-guinea, and reduce the result to the decimal of a sovereign.

14. Simplify (a) $\frac{5\frac{3}{8} - 4\frac{3}{8}}{7\frac{3}{8} + 3\frac{3}{8}}$; (b) $\frac{9\frac{1}{2} \div 3\frac{3}{10}}{4\frac{1}{4} + 2\frac{3}{4}}$; (c) $(19 \cdot 205 - 7 \cdot 65) \div \cdot 3125$.

EXERCISE CCXXXIII.

1. Reduce $\frac{47\frac{1}{2}}{238\frac{2}{3}}$ and $\frac{11\frac{1}{2}}{14\frac{2}{3}}$ to decimal fractions.

2. Reduce .0375 and .375 to vulgar fractions.

3. Reduce 7 fur. 37 pls. 2 yds. 2 ft. 3 in. to the fraction of 10 m. 7 fur. 12 pls. $2\frac{1}{2}$ yds. 9 in.

4. Find the value of $\frac{3\frac{3}{4} + 2\frac{3}{8} - 4\frac{1}{16}}{(3\frac{1}{2} \times 2\frac{3}{8}) \div 2\frac{1}{2}}$.
5. Multiply 7.914 by 39.75, and divide 75.5 by .00151.
6. If 16 horses eat 30 bushels of oats in 8 days, in how long time will 20 horses eat 30 bushels?
7. Make out a bill for the following goods : 7 cwts. 3 qrs. 14 lbs. of sugar, at 4s. per cwt.; $67\frac{1}{2}$ lbs. of tea, at 2s. 9d.; 5 cwts. 2 qrs. 16 lbs. of currants, at 35s. per cwt.; $59\frac{3}{4}$ lbs. of coffee, at 1s. 1d.; 1 ton of raisins, at $3\frac{3}{4}$ d. per lb. Write the proper receipt.
8. What is meant by (a) the greatest common measure ; (b) the least common multiple ; (c) per cent. ? Give examples.
9. What does a person receive per day when his annual income is 300 guineas?
10. Find the difference between 19008 farthings and 4301 half-crowns.
11. Make out a bill for 89 pairs of shoes, at 12s. 9d. per pair ; 1000 slippers, at 15s. for twenty ; 96 boots, at 10 guineas for a dozen pairs ; 360 cork soles, at 18s. per gross.
12. If a wheel makes 1826 revolutions in 2 m. 4261 ft., what is its circumference?
13. A loaded truck weighs 6 tons 4 cwts. 20 lbs. ; the truck itself weighs $1\frac{3}{4}$ tons ; how many packages, each weighing $6\frac{1}{2}$ lbs., does the truck contain?
14. 2 tons 14 cwts. of biscuits had to serve a ship's crew of 96 men for a fortnight ; what was each man's share per day?
15. Find the price of 5805 things, at £5 18s. $10\frac{1}{2}$ d. each.
16. Make out the cost of mowing a meadow containing 29 a. 2 rds. 35 pls., at 3s. 6d. per acre.
17. How many yards of cloth, at 10s. 6d. per yd., must be given in exchange for 180 yds. 2 qrs. of calico, at $5\frac{1}{2}$ d. per yard?
18. Two neighbours pay in the form of poor rate £1 17s. 6d. and £2 1s. 3d. respectively. The former amount is paid on a house rated at £25. What is the ratable value of the other house?

EXERCISE CCXXXIV.

1. Add together three million seventy-six thousand and eight, three million and three, eight hundred and fifty thousand five hundred and nineteen, eight hundred and sixty-three; from the sum subtract two million eight hundred and fifty thousand six hundred and forty-six; multiply the remainder by two hundred and thirty-one; and divide the product by eighty-three.

2. On what income is £5 12s. 6d. paid as tax, when the income-tax is threepence in the £?

3. How many farthings are equivalent in value to £1041 13s. 3½d.?

4. If a train be moving uniformly at the rate of 22½ miles an hour, what distance will it pass over in one second?

5. I find in my purse 33 coins, shillings and sixpences only; they amount to £1 5s. 6d.; how many of each are there?

6. Make out the following bill, and deduct 5 per cent. discount for ready cash:

13½	lbs. of beef,	at	10½	per lb.
11	„	mutton „	9½	„
8½	„	suet „	8½	„

7. If £150 will support a family of 8 persons for 10 months, how many months would £120 support a family of 5 persons?

8. Find the amount of £435 10s. in 5¼ years, at 3½ per cent. per annum, simple interest.

9. The sums invested in a business by two partners are £5500 and £3000; the profit for 9 months is £1275; what will be the share of each, and what is the rate of gain per cent. per annum?

10. An ironmonger bought nails at 18s. 6d. per cwt., and sold them at 3d. per lb.; what did he gain or lose per cent.?

11. A man who has lost $\frac{1}{2}$ of $\frac{1}{4 - \frac{1}{10}}$ of his capital has £3500 remaining; what sum did he lose?

12. A pint contains 34½ cubic inches; how many pints are there in a cubic foot of water? How many in a cubic yard?

EXERCISE CCXXXV.

1. Simplify $(2\frac{1}{2} + 1\frac{3}{4} - 3\frac{2}{3}) \times (\frac{1}{2} \text{ of } \frac{2\frac{1}{4}}{4\frac{1}{2}})$.
2. A clerk copied 62.5 instead of 625 of £100; what was the amount of his error?
3. A grocer bought butter at 1s. 1 $\frac{1}{2}$ d. per lb., and sold it at 1s. 4 $\frac{1}{2}$ d. per lb.; express his profit as a decimal of the cost price.
4. Find by decimals the rent of 89 a. 1 rd. 30 per. of land, at £2 17s. 6d. per acre.
5. The diagonal of a square field is 1000 links; find its area in acres.
6. The lb. avoirdupois being equal to 4356 kilograms, express 15 tons 12 cwts. 2 qrs. in kilograms.
7. Find the simple interest on £2187 10s. for 219 days, at 4 $\frac{1}{4}$ per cent. per annum.
8. A person left £100 per annum for ever to a school in his parish; what sum must have been invested to purchase this annuity in 3 $\frac{1}{2}$ per Cents, the stock being at 93 $\frac{1}{2}$?

EXERCISE CCXXXVI.

1. If 17 $\frac{1}{2}$ yds. of blue serge, 54 in. wide, cost £3 18s. 9d., what ought to be the cost of 30 yds. of the same quality, but only 40 in. wide?
2. If 1 cwt. of cheese cost £3 10s., what will be the cost of 2 qrs. 15 lbs.?
3. Reduce to a simple form $\frac{2\frac{1}{2} \times \frac{1}{3}}{\frac{3}{4} \times 1\frac{2}{7}} \div \frac{1\frac{2}{3} \times \frac{1}{10}}{\frac{3}{8} \times 1\frac{1}{4}}$.
4. A man returns at night with £50 in his pocket, having received 24 times as much as he had in the morning; how much had he?
5. Divide 3 cwts. 2 qrs. 7 lbs. by $\frac{1}{37}$.
6. Find the product of 7.407, 1.375, and 2.45.
7. Find the value of £18 2s. 8d. \times 46875. From 2000 subtract 852.2534, and divide the remainder by 16.38, giving the reason for the position of the decimal point in the answer.

8. From £67054 6s. 7½d. subtract £7983 12s. 10¼d., and explain as you would to a class each step of the progress.

9. Explain the process for finding the G. C. M. of two quantities, and find the G. C. M. of 185955 and 76153.

10. Explain the fact that when both numerator and denominator of a fraction are multiplied by the same number an equivalent fraction is produced, and show by way of illustration that $\frac{2 \times 3}{5 \times 3}$ is equivalent to $\frac{2}{5}$.

EXERCISE CCXXXVII.

1. Multiply seven millions five hundred and seventy-two thousand one hundred and sixty-two by eight hundred and seventeen, and divide the product by sixty-three thousand seven hundred and twenty-six.

2. Divide £31994 14s. 11½ by 63, and explain each step of the process as you would to a class.

3. Reduce 2 tons 7 cwts. 1 qr. 10 lbs. 13 oz. 11 drs. to drams, and explain each step of the process as you would to a class.

4. How often are 9 metres 7 decimetres 5 centimetres and 3 millimetres contained in 3 myriametres 4 kilometres 9 hectometres 5 metres 9 decimetres 8 centimetres and 7 millimetres?

5. Find by practice the value of 2528 articles at £3 19s. 4½d. each.

6. Make out the following bill, and deduct 5 per cent. discount for cash : 3 jars of ginger, at 5s. 7d. per jar ; 2½ dozen jars of potted salmon, at 1s. per jar ; 7 pots of essence of beef, at 2s. 6d. per pot ; 15 lbs. of cocoa nibs, at 1s. 2d. per lb. ; 32 lbs. of lump sugar, at 5½d. per lb. ; 6 lbs. of tea, at 2s. 9d. per lb.

7. Find by practice the value of 8 cwts. 2 qrs. 8 lbs. of sugar, at £2 4s. 4d. per cwt.

8. Make out the following bill, and deduct one penny in the shilling as discount for cash : 2½ reams of small note-paper, at 4s. 6d. per ream ; 4½ reams of medium note-paper, at 7s. 9d. per ream ; 4400 envelopes, small size, at 4½d. per hundred ; 5500 square

envelopes, at 4s. 2d. per thousand ; 7 packets of foreign envelopes, at 3½d. per packet ; half a gross of steel pens, at 3½d. per dozen.

9. Find the rate, at 1s. 11d. in the pound, of a parish, the ratable value of which is £8516 15s.

10. A dealer bought £1 worth of steel-pens at 1s. 4d. per box, each containing one gross, and retailed them at 2½d. per dozen ; what did he gain on his outlay ?

11. If the cost of building a wall 135 yds. 2 ft. long, and 1 ft. 9 in. thick, be £17 16s. 1½d., what would be the cost of building a wall of the same height, 86 yds. 1 ft. long and 1 ft. 10 in. thick ?

EXERCISE CCXXXVIII.

1. Simplify $\frac{1\frac{7}{8} + 2\frac{2}{5}}{6\frac{1}{2} + 3\frac{1}{3}} \times \frac{2\frac{1}{2} + 6\frac{1}{3}}{3\frac{4}{5} - 2\frac{2}{3}}$.

2. Find the value of £22 3s. 2½d. multiplied by $\frac{1\frac{3}{4} \times 1\frac{1}{4}}{4\frac{1}{2} \times 8\frac{1}{3}}$.

3. Find what fraction 4 tons 17 cwt. 2 qrs. 9 lbs. 15 oz. is of 8 tons 6 cwt. 1 qr. 25 lbs. 3 oz.

4. Divide 1332·332331 by 3·993, and multiply the result by 2·925.

5. Express £3167 9s. 0d. as the decimal of £3749 16s. 11½d.

6. Add together 5·8, 11·621, 2·489 ; also reduce the several decimals to vulgar fractions. Add them, and compare the results.

7. A pig, a cow, and a horse together were sold for £100 ; the price of the cow was three times that of the pig, and the price of the horse was four times those of the cow and pig together ; what was the price of each ?

8. How much money must be invested in the 3 per Cent. Consols at 92½ to bring in an income of £153 ?

9. A can do a piece of work in 2½ days, B can do it in 3 days, C can do it in 3¾ days ; how long will they be about it all working together ?

10. What would £120 10s. amount to in 2½ years, at 4¾ per cent. ?

11. If a broker be allowed $3\frac{1}{2}$ per cent., what may he redeem when he sells goods to the value of £816 5s. 10d. ?

12. A wall that is to be built 27 ft. high, was raised 9 ft. by 12 men in 6 days ; how many men must be employed to finish the wall in 4 days at the same rate of working ?

EXERCISE CCXXXIX.

1. Simplify $\frac{\frac{1}{5} + \frac{2}{3}}{\frac{1}{7} + \frac{7}{6}} \times \frac{\frac{1}{1} + \frac{1}{1}}{\frac{1}{1} + \frac{1}{1}}$.
2. Add together $\frac{1}{3}, \frac{1}{4}, \frac{3}{11}, \frac{2}{87}$.
3. Add together 86, 2·63, 5·819, 4·877149.
4. At what rate per cent. simple interest will £765 12s. 6d. amount to £878 3s. 5½d. in 4 yrs. 73 days ?
5. What ought to be the price of £100 of Bank Stock which pays a dividend of $10\frac{1}{4}$ per cent., in order that it may pay 4 per cent. on the money invested ?
6. A person sold £2010 in India 5 per Cents at $107\frac{1}{2}$, and invested the proceeds in 3 per Cent. Consols at $92\frac{1}{4}$; what was his change of income ?
7. If 17 metres 6 decimetres of silk cost 220 francs, what will be the cost of 25 metres 3 decimetres when the price is raised 20 per cent. ?
8. Find the cost of paper for a room 11 metres 7 decimetres long, 5 metres 8 decimetres wide, and 4 metres 2 decimetres high, at the rate of 1 franc 50 centimes per piece, being 10 metres long and 7 decimetres 5 centimetres wide.
9. Given that platinum weighs 22 times as heavy as water, and that 1 cubic centimetre of water weighs one grain ; find the weight of a rectangular piece of platinum 4 centimetres 4 millimetres long, 2 centimetres 5 millimetres wide, and 5 millimetres thick.
10. A certain quantity of work can be done in $4\frac{1}{2}$ days by 6 men, 9 women, or 12 boys ; how long would the same work occupy 4 men, 6 women, and 8 boys ?

EXERCISE CCXL.

1. Divide 8442395 by 93, and explain each step of the process as you would to a class.
2. Explain the principle on which the greatest common divisor of two numbers is found ; and find the greatest common divisor of 99108 and 68825.
3. What modification may be made in the definition of multiplication when the multiplier is an integer, so as to make it applicable to multiplication by a fraction ?
4. Show how to find the decimal fraction corresponding to a given vulgar fraction ; and express $3\frac{1911}{1811}$ in a decimal form.
5. The supply of corn at Mark Lane during the week ending September 26, 1874, was 71768 quarters of wheat, at 46s. 9d. per quarter ; 51784 quarters of barley, at 41s. 11d. per quarter ; and 4186 quarters of oats, at 27s. 9d. per quarter ; find its value.
6. What is the value of 3 cwts. 1 qr. 23 lbs. 2 ozs. 4 drs. of borax, at 1s. 4d. per lb. ?
7. A bankrupt whose debts were £2262 14s. 10d., paid 14s. 8½d. in the £ ; what were his assets ?
8. If a grocer, by selling sugar at 5½d. per lb., gain 6s. 3d. on each £ of its prime cost, what would he lose by selling it at 3½d. per lb. ?

EXERCISE CCXLI.

SET FOR STUDENTS AT A TRAINING COLLEGE.

1. $2\frac{2}{3} \times 16\frac{2}{3} \div \frac{2}{3}$ of $2\frac{2}{3}$.
2. $\sqrt{20\frac{2}{3}41}$.
3. $\sqrt{00093636} \div 2\frac{1}{2}$.
4. A courtyard 25 yards long and 7 yards wide requires a footway all round it 4 feet broad ; what will it cost to pave this footpath at 11½d. a square foot ?
5. The interest on £754 6s. 8d. for 8 months 10 days is £23 5s. ; find the rate per cent. per annum.

6. By selling a watch for 20 guineas 25% is gained ; what would have been the gain per cent. had it been sold for 18 guineas ?

7. Find by practice—

(a) $1087\frac{1}{2}$ lbs., at $11\frac{1}{2}$ d. a lb.

(b) 15 a. 24 pls., at £7 13s. 9d. per acre.

8. Income-tax at 7d. in £ on £498 15s.

9. At what price do the $3\frac{1}{2}$ per Cents pay exactly 4%, and the 5 per Cents 6% ?

10. The side of a square field containing 48 a. 10 pls. $22\frac{1}{2}$ sq. yds. 4 sq. ft. ?

11. $\sqrt[3]{128024064}$

12. A person lays by £15 a year ; what will it amount to in $5\frac{1}{2}$ years at 4% per annum ?

EXERCISE CCXLII.

1. If I am liable for a bill of £380 due in 3 months hence, and I pay it partly in cash and partly with a bill of £152 due 4 months hence, what sum must I pay down ? money worth 4 per cent. per annum.

2. A quadrilateral has its sides taken in order respectively equal to 8, 6, 10, 12 ; the sides 6 and 12 are parallel, and the shorter diagonal 10 feet ; find the area.

3. A tank, measuring 12 ft. by 8 ft. 10 in., and 6 ft. 6 in. deep, is filled with a liquid solution ; after a deposit has taken place the clear liquid is drawn off, and found to measure 4000 gallons (gal. = 277·279 c. ins.) ; find the depth of the deposit, and its value at £2 3s. $11\frac{1}{2}$ d. per c. ft.

4. A tank which has a square section and is 8 ft. deep, contain 10000 gallons ; find the side.

5. What is the exchange between London and Paris if the exchange between London and Frankfort is 11 florins 52 kreutzers for £1 sterling ; the exchange between Paris and Frankfort, 20 francs for 9 florins 20 kreutzers, and 1 florin = 60 kreutzers ?

6. Find $\left\{ \frac{1}{3} - \frac{1}{3 \times 5}^3 + \frac{1}{5 \times 5}^5 - \frac{1}{7 \times 5}^7 + \&c. \right\} \times 16 - \frac{4}{235}$
true to five decimal places.

7. What sum must a person invest in 3 per Cents at 90, in order that by selling out £1000 stock when they have risen to $92\frac{1}{2}$, and the remainder when they have fallen to 87, he may gain £5 16s. by the transaction? If he invest the produce in 4 per Cents at par, what will be the difference of income?

8. A garrison was victualled for 30 days; after 10 days it was reinforced by 3000 men; it was then found the provisions would only last 5 days; find original number of the garrison, and how many men must be sent back to enable the rest to hold out 20 days?

EXERCISE CCXLIII.

PAPERS SET BY CIVIL SERVICE COMMISSIONERS FOR
ENGINEER STUDENTS, &c.

1. Write out in words the number 230056214.
2. Write down in figures three hundred millions twelve thousand and fifty.
3. Write down in figures seventy-nine millions one hundred and twenty-two.

	£	s.	d.
4. 5678431	5. 4187	10	5
34576890	48736	16	$6\frac{1}{2}$
5720011	437	15	$7\frac{1}{2}$
2357111	596	13	$1\frac{3}{4}$
57408609	4728	9	2
63803406	9034	6	11
71257905	59	12	$10\frac{3}{4}$
689379	6827	7	3
931807194	49391	4	$6\frac{1}{2}$
803672897	40572	16	4

6. From £158763 17s. $9\frac{1}{4}$ d. take £82972 19s. $11\frac{1}{2}$ d.
7. Multiply 284153 by 60025.
8. Multiply £524 17s. $2\frac{1}{2}$ d. by 92.
9. Divide £2521838 13s. $0\frac{3}{4}$ d. by 99.

10. Divide £494278 5s. 7½d. by 129.
11. In 2486543 ounces how many tons cwts. qrs. &c.?
12. If 3¼ yards of silk cost £1 10s. 7½d., how many yards may be bought for £56 10s.?
13. Find (by practice) the value of 3 lbs. 3 oz. 5 dwts. 6 grs. of gold, at £4 18s. 3d. per ounce.
14. Find the simple interest on £25400 for 6½ years, at 3¾ per cent. per annum.
15. A printing machine turns out 3500 sheets per hour; if its speed be decreased in the ratio of 7 to 4, how many sheets may be printed in a day of 12 hours?

EXERCISE CCXLIV.

EXAMINATION OF ENGINEERS, R.N., ENGINEER STUDENTS, AND DOCKYARD APPRENTICES.

1. Find, by practice, the rent of 140 a. 3 rds. 25 pls. of land, at £1 11s. 6d. per acre.
2. *a.* Add together $2\frac{1}{8}$, $3\frac{1}{8}$, and $\frac{3}{4}$.
b. Express as decimals the fractions $\frac{17}{100}$, $\frac{87}{1000}$, $\frac{7}{5}$, $\frac{133}{222}$, and $\frac{1181}{10000}$, and as vulgar fractions in their lowest terms $\cdot475$, $\cdot008$, $\cdot07$ and $\cdot5910$.
c. Extract the square root of 33·28366864.
3. If 178 lbs. of coffee are given in exchange for 1 cwt. 4 lbs. 8 oz. of tea worth 2s. 2d. per lb., find the price of coffee per lb.
4. If 45 qrs. of wheat cost £127 13s. 6d., find the price of 195 quarters.
5. The sum of £31 2s. 6d. is to be divided among 8 men, 7 women, and 5 children, the share of each man, woman, and child being in the proportion of 5, 4, 3; find the amount of the share of each.
6. Find the present worth of a sum of £1746 14s. 2d. due 9 months hence, the rate of interest being 4 per cent. per annum.
7. A man buying goods at the rate of 10s. per cwt. sells 5 tons 4 cwts. 2 qrs. for £57 9s. 6d.; find his gain or loss per cent.

8. If the rate of exchange between England and Spain be 21s. for 4 piastres, and that between France and England be 20 francs 25 centimes for 15s. 8½d., how many francs should be given for 132 piastres?

9. A person invests in 4 per Cents stock, so as to obtain 4½ per cent. clear on his investment, when there is an income-tax of 1s. in the pound, the brokerage being ¼ per cent. ; at what price must he buy?

EXERCISE CCXLV.

1. At what rate per annum (simple interest) will £1225 amount to £1417 18s. 9d. in 3 years?

2. Add together $\frac{1}{30}$, $3\frac{1}{6}$, $4\frac{2}{3}$, and $\frac{5}{15}$.

3. Subtract $13\frac{1}{3}$ from $20\frac{1}{2}$.

4. Multiply together $6\frac{2}{3}$, $2\frac{1}{3}$, $\frac{5}{11}$, and $\frac{7}{13}$.

5. Divide $2\frac{1}{11}$ by $1\frac{1}{4}$.

6. Add together 37 of a day, and 0761 of an hour, and give the answer in minutes and the decimal fraction of a minute.

7. Subtract 65 of a perch from 04 of an acre, and give the answer in square yards, square feet, &c.

8. Multiply 48.725 by 00396.

9. Divide 073776 by 024.

10. Divide 904878 by 3867.

11. Express 2s. 4d. as the decimal of a guinea.

12. Find the square root of $1\frac{51}{52}$, and the cube root of $11\frac{7}{13}$.

13. Divide £340 among 4 persons A, B, C, and D, so that A may have twice as much as B, and B twice as much as C, and C twice as much as D.

14. Find the present value of £1336 11s. 3d. due at the end of $3\frac{1}{2}$ yrs., at 5 per cent.

15. By disposing of goods for £364 a man loses 9 per cent. ; what should have been the selling price in order that a profit of 7 per cent. might have been made?

EXERCISE CCXLVI.

EXAMINATION OF ENGINEERS, R.N.

1. A person gives £3 to pay for lodgings during the month of August, at 1s. 8d. per night ; what sum will be returned to him ?

2. In marching, soldiers take 75 steps a minute, in quick marching 108 ; how far would a regiment advance in three hours, the last hour at quick march, reckoning each step as 2 ft. 8 in. ?

3. Twenty-six wedges of gold, weighing in all 33 lbs. 3 oz. 11 dwts. 14 grs., are to be coined into guineas ; find the weight of each wedge, and the number of guineas coined from the whole, at the rate of $3\frac{1}{4}$ guineas per oz.

4. Express $1618\frac{1}{2}$ English miles in degrees (a degree = $69\frac{1}{2}$ miles) ; find the value of $\frac{1}{5}$ of £2 7s. 8½d. and of $\frac{3}{10}$ of £1 6s. 8d. ; and reduce their difference to the decimal of £20.

5. Add together the cube roots of .007301384 and 32768, and multiply the result by the square root of $72\frac{1}{2}$.

6. Reduce $\frac{2.8 \text{ of } 2\cdot\dot{2}\dot{7}}{1\cdot\dot{1}\dot{3}\dot{6}} + \frac{4\cdot\dot{4} - 2\cdot\dot{8}\dot{3}}{1\cdot\dot{6} + 2\cdot\dot{6}\dot{2}\dot{9}}$ of $\frac{6.8 \text{ of } 3}{2.25}$ to a simple quantity.

7. If $\frac{1}{102}$ of $\frac{2}{3}$ of $2\frac{1}{2}$ of 40 lbs. of beef cost $1\frac{3}{5}$ d., how many lbs. may be bought at the same rate for 6s. $7\frac{1}{2}$ d. ?

8. If 7 masons can erect a certain piece of wall in $20\frac{5}{8}$ days of $9\frac{3}{4}$ hours each, how long would it take 3 masons to do $2\frac{1}{2}$ of the same work, reckoning 12 hours to the day ?

9. A person rents a piece of land for £120 a-year ; he lays out £625 in buying 50 bullocks ; at the end of a year he sells them, having expended £12 10s. in labour ; how much per head must he gain by them in order to realise his rent and expenses and 10 per cent. on his original outlay ?

10. A person in London owes another in St. Petersburg a debt of 460 roubles, which must be remitted through Paris ; he pays the requisite sum to his broker at a time when the exchange between London and Paris is 23 francs for £1, and between Paris and St. Petersburg 2 francs for 1 rouble. The remittance is delayed until the rates of exchange are 24 francs for £1, and 3 francs for 2 roubles ; what does the broker gain or lose by the transaction ?

11. What will be the cost of painting a room at $9\frac{1}{2}$ d. per square yard, if the sides are each 19 ft. $10\frac{1}{4}$ in., the ends 16 ft. $1\frac{3}{4}$ in., and the height 10 ft. 3 in.?

12. A garden is in the form of a rectangle, whose sides are 47 and 31 feet respectively; three circular plots are cut out of it, whose diameters are 14 ft., 14 ft., and 23 ft., respectively; find the expense of covering the remainder with gravel 3 in. thick, a cubic yard of gravel being worth 5s. 3d.

EXERCISE CCXLVII.

1. What will be the cost of 2395 $\frac{7}{8}$ articles, at £2 17s. 10d. each?
2. Find the value of a field measuring 7 a. 3 rds. 20 yds., at £396 per acre.
3. Find the cost of carpeting and papering a room, 32 ft. 6 in. long, 27 ft. 3 in. broad, and 16 ft. high; the cost of carpet $\frac{3}{4}$ yd. wide being 4s. $4\frac{1}{2}$ d. per yd., and the cost of paper 2 ft. wide being $10\frac{1}{2}$ d. per yd.
4. Gunpowder is composed of 33 parts of nitre, 7 of charcoal, and 5 of sulphur; what weight of each of these components is contained in a ton of gunpowder?
5. Find the cost price of goods sold for £27 14s., at a gain of $7\frac{1}{2}$ per cent.
6. How many gallons of water will be required to fill a cylindrical tank 20 ft. 2 in. deep, and 21 ft. in diameter; a cubic foot of water weighing 1000 oz., and a gallon weighing 10 lbs.?

EXERCISE CCXLVIII.

1. Find the value in cwts. qrs. and lbs. of 1·7300223214285 $\dot{7}$ ton; reduce 15s. $10\frac{1}{2}$ d. to the decimal of £5 7s. 6d.; and 10 a. 50 sq. yds. to the decimal of a square mile.
2. Find the value of $11\cdot2\dot{3}6$ of $\frac{1}{8}$ of £2 + $\frac{2\frac{1}{5}}{2\frac{9}{10}}$ of 2·04752 of 8s. 4d.
3. A debtor arranges with his creditors to pay 2s. 6d. in the pound

down, 2s. 6d. in 3 months, 3s. in 5 months, and 2s. 6d. in 8 months ; if he owe £1976 13s. 1d., find the present value of his assets, allowing interest at 4 per cent.

4. Find the simple interest on £885 15s. at $5\frac{1}{2}$ per cent. for $2\frac{1}{2}$ years.

5. By how much will the compound interest on £675 at 5 per cent. per annum, for 2 years, be increased by the interest being paid half-yearly instead of annually ?

6. If the 3 per Cents be at 93 and the 4 per Cents at 115, how much will the income of a man be increased by his selling £10000, 3 per Cents stock, and investing the proceeds in the 4 per Cents ?

EXERCISE CCXLIX.

1. Write out in words the number 123543876.

2. Write down in figures, four hundred million one hundred and twenty thousand three hundred and one.

3. Write down in figures, sixty-three million one hundred and twenty-two.

4. Add together :

35678434
54576890
5729011
2357411
57498609
63803496
71257905
20689379
934807494
873673877

5. Add together :

£	s.	d.
4487	10	3
48736	16	$6\frac{1}{2}$
3437	15	$7\frac{1}{2}$
596	13	$4\frac{3}{4}$
4728	5	3
9034	6	11
1059	12	$10\frac{3}{4}$
6837	17	5
49394	4	$6\frac{1}{2}$
49572	16	4

6. From £367851 15s. $8\frac{1}{4}$ d. take £27928 19s. $11\frac{3}{4}$ d.

7. Multiply 351482 by 52006.

8. Multiply £425 17s. $3\frac{1}{4}$ d. by 29.

9. Divide £950590 11s. $8\frac{3}{4}$ d. by 77.

10. Divide £607900 14s. 5½d. by 123.
11. In 3456842 oz. how many tons, cwts., qrs., &c.?
12. If 3 lbs. of sugar cost 3s. 2½d., how many lbs. may be bought for £4 17s. 10½d.?
13. Find, by practice, the value of 3107 articles at £1 14s. 7½d. each.
14. Find the simple interest on £4200 for 6½ years, at 4½ per cent. per annum.
15. If the 4d. loaf weigh 24 oz. when wheat is at 50s. per qr., what is the price of wheat when the 6d. loaf weighs 30 oz.?
16. At what rate per cent. (simple interest) will £1300 amount to £2032 6s. 8d. in 4½ years?
17. Add together $\frac{1}{30}$, $3\frac{1}{8}$, $4\frac{2}{3}$, and $\frac{1}{15}$.
18. Subtract $16\frac{7}{16}$ from $21\frac{1}{8}$.
19. Multiply together $6\frac{1}{2}$, $\frac{5}{12}$, $\frac{7}{11}$, and $2\frac{1}{2}$.
20. Divide $2\frac{3}{11}$ by $7\frac{1}{2}$.
21. Add together .73 of a day and .0167 of an hour, and give the answer in minutes and the decimal fraction of a minute.
22. Subtract .56 of a perch from .03 of an acre, and give the answer in sq. yds., sq. ft., &c.
23. Multiply 52.784 by .00693.
24. Divide .067737 by .042 to 3 places of decimals.
25. Divide 60.27985 by 5.311.
26. Express 3s. 4d. as the decimal of a guinea.
27. Find the square root of $154751\frac{77}{169}$, and the cube root of 731189187729.
28. A grocer mixes 3 cwts. of tea which cost him 16 guineas a cwt. with one cwt. which cost him £19 12s.; at what rate per lb. must he sell the mixture so as to gain 4 per cent. on his outlay?
29. Divide £354 14s. 1½d. among 4 persons, in the proportion of the fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{8}$.
30. Find the value of 5.49 of .047619 of twenty-five guineas.

EXCISE COMPETITION.

EXERCISE CCL

1. From the sum of $\frac{2}{3}$, $7\frac{1}{8}$, and 1, take the sum of $2\frac{1}{2}$ and $1\frac{1}{12}$, and divide the remainder under by $\frac{1}{3}\frac{1}{8}$.
2. Multiply $1\frac{2}{7}$ by $3\frac{3}{7}$ and then by $1\frac{1}{8}$.
3. Divide 4.41 by .00103 to two places of decimals ; express the result in words.
4. Bought brandy at 32s. 6d. per proof gallon, reduced it to 10 U. P. and sold it at 31s. 6d. per gallon ; what was the gain or loss ?
5. Raise 300 gallons of spirits from 7 O. P. to 11 O. P. by spirits at 13 O. P.
6. Find the income of a person who pays £15 10s. income-tax, at 3d. in the £.
7. Goods were sold at a profit of 15 per cent. for £82 ; find cost price.
8. Find the cost of 10 tons 5 cwts. 3 qrs. 7 lbs., at £2 16s. 4d. per cwt.

EXERCISE CCLI.

1. Give a short method for finding the square root of any number, and extract the square root of 17 to 8 places of decimals.
2. Find the cube root of 76440958.784.
3. Multiply by duodecimals 7 ft. 8 in. 7 pts. by 3 ft. 7 in. 11 pts., and express the product in square inches and fractions.
4. A person invests £4728 in railway shares at 115, with an annual dividend of £5 ; he afterwards sells out at 125, and buys Consols 3 per Cents at 93. Find the change in his income.
5. A reservoir is $40\frac{1}{2}$ ft. long and 12 ft. broad, and its contents 1471 cubic feet 432 cubic inches. Find its depth and weight, when the weight of a cubic inch of water is 252 grains.

6. State the rule for dividing by composite numbers. Divide according to that rule 2875962 by 165.

7. Simplify $\frac{\frac{3}{8} + \frac{1}{8}}{\frac{1}{16} + \frac{1}{4}} \div \frac{\frac{4}{8} + \frac{2}{8}}{\frac{3}{8} + \frac{3}{8}}$ of 13 tons 7 cwt. 3 qrs. 12 lbs.; and reduce the result to the decimal of a ton.

8. If 24 men in 6 days of 8 hours dig a trench 140 in. long, 4 in wide, and 2 in. deep, how many days of 10 hours will 90 men be digging a trench 6 in. wide, 4 in. deep, and 490 in. long?

9. If by selling an article which cost £14 per cwt., at 2s. 9½d. per lb., one makes 5 per cent. more profit than by selling the whole for £55 15s. 3½d., how much was sold?

10. Reduce $\frac{102366}{141}$ of 22½ of 59 of 234 to vulgar fractions of lowest terms.

11. Ten men working 10½ hours a day can complete a certain work in 9 days. If, however, 3 of the men can work only 6 hours a day, how long per day must the other 7 men work to complete the work in 10 days?

12. If the discount on £930 7s. 6d. at 3½ per cent. be £3 7s. 6d., when is the money due?

13. A person can discharge a debt by paying £1771 at end of first, second, and third year respectively. If interest be reckoned at 5 per cent., what is the amount of the debt?

14. If 0.359375 of a ton cost £1.200125, how much can be had for 13.5416 of a guinea?

EXERCISE CCLII.

1. Find the square root of .0003418801, and the cube root of ¼ correct to 7 places of decimals.

2. Find the least number which is divisible by all the numbers up to 15 inclusive.

3. If 7 oz. of gold, 22 carats fine, 12½ oz., 21 carats fine, and 17 oz., 18 carats fine, are melted together, what is the fineness of the compound?

4. A garrison of 4500 men is provisioned for 15 weeks at the rate

of 13 oz. per diem per man, how many men must leave, that the same provisions may last those who remain 27 weeks at 10 ozs. per diem each man ?

5. Reduce to their simplest forms,

$$\frac{3\frac{3}{8} - 9}{\frac{8}{8} - \frac{7}{8}} \div \frac{\frac{1}{2} + \frac{1}{3} + \frac{10}{12}}{\frac{4}{8} - \frac{7}{8}}; \text{ and } \frac{1}{2 + \frac{1}{\frac{1}{2 + \frac{1}{2}}}}$$

6. What is the present worth of a bill for £694 10s., due $3\frac{1}{2}$ years hence, at $4\frac{1}{2}$ per cent., simple interest ?

7. If $1\frac{3}{4}$ yards of cloth are worth $\frac{1}{12}$ of a bushel of corn, and 12 yards of cloth will fetch $4\frac{1}{2}$ dollars, what is the value of 5 quarters of corn, a dollar being equal to 4s. 2d. ?

8. If a company of 160 men, in 6 days of 11 hours each, can dig a trench 230 yards long, $5\frac{1}{2}$ wide, $1\frac{1}{2}$ deep, in how many days of 8 hours each would 96 men dig a trench 220 yards long, $3\frac{1}{2}$ wide, and 1 deep, supposing the hardness of the ground in the former case is to that of the latter as 5, 7, and that 4 men of the latter company can do as much work as 5 of the former in the same time ?

9. Two persons, A and B, hold ground in a common at a rental of £54; A puts in 23 horses for 27 days, and B 21 horses for 39 days; how much should be paid by each ?

10. Find by duodecimals, the capacity of a tank 36 ft. 7 in. long, 7 ft. 11 in. deep; 6 ft. 10 in. wide; and give the result in cubic yards, feet, and inches.

11. A and B working together do a piece of work in 7 days, B working alone can do it in 13 days. Suppose B works 3 days, how long will A have to finish the work ?

12. A contractor agrees to sink an artesian well on the following terms : £5 per fathom for the first 30 fathoms (consisting of gravel only), £35 per fathom through the sand, £20 per fathom through clay, and £25 through chalk. He found the thickness of the chalk to be equal to half the depth of the well, and that the sand beds were three times as thick as the clay. At the end of the work he got £2700 for his trouble. What was the depth of the well ?

13. A and B starting at opposite corners of a square, whose side is 100 yards long, walk round it in the same direction; A walks 19

yards, while B walks 16. At what part of the square will they be together, and what number of times will each have passed the corner from whence they started?

14. A speculator bought Spanish bonds (yielding no interest) at 18, 18 Honduras £100 bonds paying 10 per cent. interest at 35, and 27 Turkish £100 bonds paying 5 per cent. interest at 45. At the end of two years he sells the Honduras stock at 15, and the following year he sold the Spanish at 25, and the Turkish at 46. Including the interest, he gained £1146. What number of Spanish bonds did he buy?

15. A and B enter into business together, A gives $\frac{2}{3}$ of the capital; at the end of the first year they have made a profit of $3\frac{1}{2}$ per cent., and at the end of the second a profit of 5 per cent.; at the end of the third year they are bankrupts, and can only pay 10s. in the pound. The remaining money is £16663 10s. How much did each contribute?

EXERCISE CCLIII.

HIGHER ARITHMETIC.

Time allowed—three hours.

1. At what rate per cent., simple interest, will £900 amount to £1120 10s., in 7 years?

2. There are in a manufactory a certain number of workmen who receive 50s. a week; twice as many who receive 31s. 6d. a week; and eleven times as many who receive 14s. a week; the total amount paid for the workmen's wages is £93 9s.; find the number of workmen.

3. If a coach travel at the rate of $9\frac{1}{2}$ miles per hour, and a railway train run 25 miles while the coach is going 8 miles, how much time will a traveller save in a journey of 152 miles by adopting the train as his mode of travelling?

4. If 200 men can make an embankment 5 miles long in 25 days, how much overtime must 60 men work in order to finish an embankment 2 miles long in 32 days, 12 hours being taken as a day's work?

5. Extract the cube root of 1194389981 ; and the square root of 154751 $\frac{77}{169}$.

6. A room, three times as long as it is broad, is carpeted at 4s. 6d. a square yard, and the walls are coloured at 9d. per square yard, the respective cost being £8 5s. 4 $\frac{1}{2}$ d. and 4 guineas ; find the dimensions of the room.

7. Divide $\cdot 37$ by $1\cdot 17$; multiply the result by the quotient of $\cdot 052$ divided by $18'$, and give the answer in the form of a vulgar fraction.

8. Divide £857 5s. 8 $\frac{1}{2}$ d. among four persons, A, B, C, and D, so that A may have twice as much as B, B three times as much as C, and C four times as much as D.

9. Find the present worth of £2674 6s., due 3 years hence, at 4 $\frac{3}{4}$ per cent.

10. By disposing of goods for £9 10s., a man loses 5 per cent. ; what would he gain or lose if he sold them for £11 17s. 6d. ?

11. Find, by duodecimals, the solid content of a room 14 ft. 7 in. long, 12 ft. 5 in. wide, and 11 ft. 3 in. high ; express the result in cubic feet and fractions of a cubic foot.

12. The sides of a quadrilateral field, A, B, C, D, are as follows : A B 200 links ; B C 650 links ; C D 905 links ; A D 570 links ; and the diagonal A C = 800 links. Find the area of the field.

13. Find, within an inch, the diameter of a circle whose area is 100 square yards.

14. A rectangular block of granite is 10 ft. 6 in. in length, 8 ft. 3 in. in width, and 4 ft. deep ; find the length of the edge of a cube (to two places of decimals) which has the same solid contents.

15. A builder contracted to build a house in 12 weeks, and agreed to pay £5 for each day, or part of a day, that the work remained incomplete after the end of that period. To fulfil his contract he engaged 15 men to work 10 hours a day ; at the end of three weeks ten of the men struck and remained away from their work for a fortnight. After their return the number of working hours was reduced to 9. What was due from the contractor ?

EXERCISE CCLIV.

ARITHMETIC FOR REVENUE OFFICERS.

1. Reduce to a common denominator
 $\frac{29}{24}, \frac{9}{24}, \frac{7}{24}, \frac{792}{1320}, \frac{231}{1320}, \frac{288}{1320}, \frac{550}{1320}, \frac{78624}{222768}, \frac{87516}{222768}, \frac{80325}{222768}$.
2. What is the value of $\frac{1}{4}$ ths of a £ sterling?
3. What is the value of $\frac{1}{3}$ ths of £24 16s. 10 $\frac{1}{2}$ d.?
4. Reduce 3s. 7 $\frac{1}{2}$ d. to the fraction of £1 3s. 4 $\frac{1}{2}$ d.
5. Add together $\frac{1}{3}$ ths of a £, $\frac{2}{5}$ ths of 6s. 8d., $\frac{1}{10}$ th of a crown, and $\frac{1}{6}$ ths of a penny.
6. Add together $\frac{3}{8}$, $\frac{2}{9}$, $\frac{1}{13}$ th of $9\frac{3}{4}$, and subtract the result from $5\frac{1}{2}$.
7. Subtract $\frac{1}{3}$ ths of $6\frac{3}{8}$ from $\frac{1}{4}$ ths of $10\frac{1}{2}$.
8. Reduce $6\frac{1}{2}$ of $\frac{11}{123}$ to a single fraction, and divide it by $3\frac{2}{3}$.
9. What number multiplied by $\frac{1}{16}$ will give $4\frac{1}{2}$ as the product?
10. If $\frac{1}{4}$ ths of a lb. cost $\frac{1}{8}$ ths of a shilling, what will $\frac{1}{11}$ ths of a lb. cost at that rate?
11. Express as a decimal fraction the sum of 2, $\frac{2}{3}$, $\frac{5}{1000}$, and $\frac{1}{2000}$.
12. Multiply 325·701428 by ·7218393, retaining only 3 decimal places in the product.
13. Divide ·00128 by 8·192 (using the contracted method) to 6 places of decimals.
14. Add 1·7235 to ·00456; subtract from the sum ·9830543; multiply the remainder by ·001, and divide the product by ·25 to four significant figures of decimals.
15. Multiply 85 millions by 6 ten thousands, and divide the result by 264 hundred thousand to six places of decimals, expressing the result in words.

EXERCISE CCLV.

1. Find the value of £·90625 added to 2·396875s. added to 1·4375d.

2. Reduce $\frac{4\frac{1}{2}}{758}$ to a decimal, and divide it to five places of decimals of $\frac{1}{7}$ of $9\frac{1}{2}$.
3. Reduce £2 3s. 3 $\frac{1}{2}$ d. to the decimal of 4.
4. Find the fourth proportional to 5·2, 7, and 3·25.
5. Find the fourth proportional to $\frac{7}{8}$, $\frac{5}{8}$, and $\frac{2\frac{1}{2}}{11}$.
6. Find the fourth proportional to $\frac{1}{13}$, $\frac{1}{14}$, $\frac{1}{15}$; subtract fourth proportional to $\frac{1}{14}$, $\frac{1}{15}$, and $\frac{1}{16}$.
7. What is the third proportional to ·0025 and ·705?
8. If a distiller use, instead of a true gallon, a measure which is deficient by a quarter of a pint, what quantity will be represented by 100 of such false measures?
9. The duty on malt is 2s. 8 $\frac{5}{100}$ d. per bushel; how many bushels corresponded to the duty of £162 15s.?
10. If the prime cost of leaf tobacco inclusive of the duty amount to £21 16s. 9 $\frac{8}{100}$ d. per cent., what weight of water must be added to each cwt. so that the manufactured tobacco may be sold, without any advance on the cost price, at a profit of 2d. per lb.?

EXERCISE CCLVI.

1. What is the interest on £2755 15s. for 3 years 110 days at 3 $\frac{1}{2}$ per cent.?
2. What is the amount of £1158 17s. 6d. for 1 year 115 days, at £2 10s. per cent.?
3. If £450 amount to £523 10s. in 1 year 8 months, calculate the rate per cent.
4. In what time will £750 amount to £1125, at 5 per cent.?
5. What principal will amount to £900 in 4 years, at 6 $\frac{1}{2}$ per cent.?
6. Apples bought at 5s. 9d. per hundred were sold at a profit equal to 3·7ths of the selling price; required the selling price and the gain per cent.
7. Leaf tobacco cost 10d. per lb. in bond; the duty is 3s. 2d. If

35 per cent. of water be absorbed during the process of manufacture what price will give a profit of 15 per cent. ?

8. If 210 gallons of spirits were bought at 12s. 6d. per gallon, 3 per cent. was lost by leakage, and the remainder was sold at 14s. 2d. a gallon ; what was the gain or loss per cent. ?

9. By how much per cent. does $\frac{2}{3}$ exceed $\frac{3}{4}$?

10. By selling malt at 66s. a quarter, 8 per cent. was gained ; what was the cost price ?

11. What quantity of spirits worth 14s. per gallon should be blended with 41 gallons of other spirits at 9s. 6d. and 59 gallons at 10s. 8d. so that the mixture be worth 11s. 6d. per gallon ?

EXERCISE CCLVII.

CIVIL SERVICE EXAMINATION.

1. Reduce 5 tons 3 qrs. 17 lbs. 13 oz. to ounces.
2. How much must be given for 29 articles at £3 16s. 6d. a dozen ?
3. Find by practice the value of 7128 articles, at £4 5s. 10 $\frac{1}{2}$ d. a piece.
4. Find the simple interest on £348 10s. for 7 years, at 4 $\frac{1}{2}$ per cent. per annum.
5. Add together 3 $\frac{2}{3}$, $\frac{4}{5}$, 1 $\frac{1}{2}$, and $\frac{7}{10}$.
6. Subtract 5 $\frac{1}{2}$ from 8 $\frac{3}{4}$.
7. Multiply 14 $\frac{1}{2}$ by 10 $\frac{1}{2}$.
8. Divide 17 $\frac{5}{8}$ by 19 $\frac{3}{4}$.
9. Add together 381·105, 4·692, ·0001, and 54·0096.
10. Subtract 392·68154 from 400·0612.
11. Multiply 129·342 by 5·26.
12. Divide 79·105 by 12·086 to four places of decimals.
13. Reduce ·334375 of a pound to shillings and pence.
14. In 32478621 inches how many miles, furlongs, yards, &c. ?
15. When wheat is 60s. per quarter, the 6d. loaf weighs 4 lbs. ; what should be paid for 25 lbs. when wheat is 40s. per quarter ?

16. Find by practice the price of 3 lbs. 5 oz. 14 dwts. 12 grs. at 17s. 6d. per ounce.
17. Find the amount of £412 10s. for three years at 6 per cent., compound interest, neglecting fractions of a penny.
18. Add together $1\frac{1}{4}$, $1\frac{1}{8}$, $\frac{3}{4}$ and $2\frac{1}{2}$.
19. Subtract $10\frac{1}{3}$ from $16\frac{5}{6}$.
20. Multiply $4\frac{2}{3}$ by $\frac{3}{7}$.
21. Divide $10\frac{8}{9}$ by $\frac{4}{3}$.
22. Add together 39·0016, 4215·05, ·07364, and 1·009.
23. Subtract 38·09652 from 100.
24. Multiply 30·561 by ·0016.
25. Divide ·030734 by 20·56 to four places of decimals.
26. Reduce 121121 inches to the decimal of a mile.

EXERCISE CCLVIII.

1. Reduce 10 a. 3 pls. $10\frac{1}{4}$ square yds. to square inches.
2. If 7 men working 16 days can mow a field of corn 1320 yards long and 880 wide, what will be the length of the side of a field 1320 yards broad which 4 men can mow in 42 days?
3. Find by practice the cost of a telegram, consisting of 425 words, at £1 12s. 6d. for twenty words.
4. In what time will £225 amount to £256 10s. at 4 per cent. simple interest?
5. Add together $3\frac{1}{2}$, $10\frac{1}{12}$, $\frac{1}{2}$, and $1\frac{1}{4}$.
6. Subtract $\frac{1}{3}$ from $2\frac{1}{4}$.
7. Multiply together $\frac{2}{3}$, $\frac{1}{4}$, $1\frac{2}{3}$ and $\frac{8}{9}$.
8. Divide $3\frac{2}{3}$ by $14\frac{1}{2}$.
9. Add together 374·826, ·19241, ·09059, and ·006.
10. Subtract 426·5793 from 510·81.
11. Multiply ·10065 by 428.
12. Divide ·00329875 by ·0754.
13. Reduce $10\frac{3}{4}$ d. to the decimal of 1s. 6d.

EXERCISE CCLIX.

1. A man has £576 6s. 8d. per annum, after paying income-tax at the rate of 5d. in the pound ; what is his income ?
2. Find the square root of '000961, and prove the correctness of the result obtained. What is the length in inches of the side of a cubical box which contains '000027 cubic yards ?
3. At what rate per cent. simple interest will 3s. 2d. produce 3s. 6d. interest in $33\frac{1}{2}$ years ?
4. If a person by selling sugar at $5\frac{1}{4}$ d. per lb. loses 12 per cent., at what price per cent. must he sell it in order to gain 8 per cent. ?
5. Find the cost of painting the four walls of a room at 8d. a square yard, the length of the room being 18 ft. $6\frac{1}{2}$ in., the breadth 16 ft. $5\frac{1}{4}$ in., and the height 12 ft.
6. Add together 2'6 of a day, and '85 of an hour, and give the answer in minutes.
7. What is the income-tax of a man whose income-tax at 4d. in the £ amounts to 23 guineas ?
8. Find the dividend on £274 10s. at 8s. 3d. in the £.
9. If 2 horses can plough 7 acres of ground in a day, how many horses will be required to plough 161 acres in $11\frac{1}{2}$ days ?
10. If 1 ton 5 cwt. of iron cost £1 11s. 3d., what will 1 cwt. 2 qrs. cost ?
11. If either 50 oxen or 7 horses will eat up the grass of a field in 87 days, in what time will 4 oxen and 6 horses eat up the same ?

EXERCISE CCLX.

1. Extract the square root of 3915380329 and of $83\frac{1}{2}\frac{1}{2}\frac{1}{2}$.
2. By selling goods for £817 19s., a person lost 9 per cent. on his outlay ; find at what price he should have sold them in order to have gained $10\frac{1}{2}$ per cent.
3. What is the decimal of $\frac{124}{1264}$?
4. What is the decimal of $\frac{1}{2}$ d. of £1 ?
5. What is the decimal of 7d. of £1 ?

6. What is the decimal of 1 pint of a bushel ?
7. What is the decimal of 1 day of a year ?
8. Reduce 2s. 7d. to the decimal of £1.
9. Reduce 2s. $8\frac{1}{2}$ d. to the decimal of £1.
10. Reduce 3s. 8d. to the decimal of £1.
11. Reduce $1\frac{1}{2}$ d. to the decimal of £1.
12. Reduce 3 bushels 1 peck to the decimal of 1 quarter.
13. Reduce $6\frac{3}{4}$ inches to the decimal of a yard.

EXERCISE CCLXI.

1. Reduce $\frac{3}{8}$ to a decimal.
2. Reduce £2 3s. $4\frac{1}{2}$ d. to the decimal of £1.
3. What is the value of .778125 of a pound ?
4. What is the value of .1875 of a pound ?
5. What is the value of .125 of a shilling ?
6. What is the value of .40625 of a quarter ?
7. What is the value of .5625 of a foot ?
8. What is the additional duty at 5 per cent. on 50 brewers' licences amounting together to £140 ?
9. What is the additional duty at 5 per cent. on malt duty amounting to £51 13s. 4d. ?
10. If an officer's salary be 5s. $5\frac{1}{4}$ d. per day, what is that per year ?
11. If $1\frac{7}{8}$ bushels of malt produce 2 gallons of spirits, what will 750 bushels produce ?
12. What is the interest of £547 15s. for a year, at 5 per cent. ?
13. How much per cent. is the price of malt enhanced by the duty when it sells at 8s. 6d. per bushel ?

CUSTOMS.

EXERCISE CCLXII.

1. Addition : $\frac{3}{4}$ of 18 + $\frac{3}{8}$ of $1\frac{1}{2}$.
2. Subtraction : $4\frac{7}{8} - \frac{1}{4}$ of $\frac{3}{4}$.
3. Multiplication : $6\frac{3}{4}$ of $7\frac{1}{2} \times 2\frac{5}{8}$ of 21.
4. Find the value of $\frac{5\frac{5}{8} + \frac{3}{8}}{1\frac{1}{8} \text{ of } \frac{8}{9} \div 10\frac{1}{2}} \times \frac{2}{3}$ of $\frac{1\frac{1}{2} \text{ of } 4\frac{1}{2}}{13\frac{1}{8} \text{ of } 5\frac{1}{4}}$.
5. Division : $16\frac{2}{3} \div 12\frac{1}{2}$.
6. Reduce $1\frac{3}{4}$ hours to the fraction of 10 minutes.
7. Addition : 11·275 + ·34132 + ·00414 + ·0001 + 23.
8. Subtraction : 3·412 - 2·99997.
9. Multiplication : 32·1 \times 2·31.
10. Division : 18·13 \div ·00037.
11. Find what decimal multiplied by 175 will give the sum of $\frac{1}{4} + 1\frac{1}{2} + 3\frac{1}{2}$.
12. Find, by practice, the value of 37 yds. 2 ft. 7 in. of silk, at 5s. $3\frac{1}{4}$ d. a yard, and prove the result by the Rule of Three in decimals.
13. Find, by cross multiplication, the contents of a cube whose edge is 2 ft. 8 in., and prove the result by Vulgar Fractions.
14. The prime cost of a 50-gallon cask of wine is £25, and 10 gallons are lost by leakage ; at what price per gallon must the remainder be sold so as to gain 10 per cent. on the original cost ?
15. How many francs must be transmitted from Paris to Berlin to discharge a debt of 420 thalers, a thaler being equivalent to 3s., and 24 francs to £1 ?
16. A banker borrows money at $3\frac{1}{2}$ per cent., and pays the interest at the end of the year. He lends it out at 5 per cent., but receives the interest half-yearly, and by this means gains £200 a year. How much does he borrow ?
17. The value of a pound of gold is seventeen times that of a pound of silver, and the weights of equal quantities of gold and

silver are in the ratios of 19 to 10 ; find the value of a bar of silver equal in bulk to £1750 worth of gold.

18. Find the compound interest on £750 for three years, at 4 per cent. per annum.

19. If $\frac{3}{8}$ ths of a ship be worth £3740, what is the value of the whole ?

EXAMINATION OF DIVISION OFFICERS OF INLAND REVENUE.

EXERCISE CCLXIII.

1. Find the product of the sum and difference of $6\frac{1}{2}$ and $6\frac{1}{4}$.
2. From the sum of the numbers of $\frac{3}{4}$, $7\frac{1}{2}$, and 3, take the sum of $2\frac{1}{2}$ and $1\frac{1}{2}$, and divide the remainder by $\frac{1}{8}$.
3. If the circumference of a circle be 1, the diameter is $\frac{7}{22}$ nearly, or $\frac{11}{22}$ nearer ; give each of these decimally to four figures, and express the first in words.
4. What is the value of .3945 of a day, in hours, minutes, and seconds ?
5. If a merchant's clerk has a salary of £89 12s. 6d. per annum, commencing 1st May, how much has he to receive on leaving his situation on the 17th December inclusive ?
6. After A has travelled 51 miles, B sets out to overtake him, and for 16 miles travelled by A 19 miles are constantly travelled by B ; how far will each have travelled before A will be overtaken ?
7. If a dealer in spirits use, instead of a gallon, a measure which is deficient by $\frac{1}{2}$ a pint, what will be the true measure of 100 of these false gallons ?
8. Required, by practice, the price of 198 cwts. 2 qrs. 21 lbs., at £4 8s. 8d. per cwt. ?
9. If a puncheon of rum containing 85 gallons cost £58 8s. 9d., what will be the value of a hogshead containing 63 gallons, and composed of 4 parts of the same rum and 1 part of water ?

10. What quantity of spirits at 14s. per gallon must be added to a mixture consisting of 41 gallons at 9s. 6d., and 59 gallons at 10s. 8d., to make a compound worth 11s. 6d. per gallon ?

11. If the price of duty-free malt be 28s. per quarter, and of British spirits in bond 1s. 6d. per proof gallon, how much per cent. would the price of each article be increased by the duty ?

The duty on malt is 2s. 7d. + 5 per. cent. per bush., and on spirits 10s. 6d. per gal., with a reduction of 5 per cent. on duty and price.

12. A landlord has an estate which brings in £2000 a year, subject to a deduction of 12 per cent. He sells it for £40000, and invests the money in 3 per Cent. Consols at £97 ; find the difference in his income.

SPECIMEN PAPERS SET BY OXFORD AND CAMBRIDGE LOCAL EXAMINATIONS.

EXERCISE CCLXIV.

1. Multiply one hundred and forty-seven thousand two hundred and ninety-seven by six thousand seven hundred and eighty-nine.

2. Divide thirty-four million twenty-four thousand three hundred and seventy-five by four thousand three hundred and seventy-five.

3. After paying, out of £100, £20 13s. 4½d. to my butcher, £30 15s. 6½d. to my tailor, and £46 13s. 11¼d. to my grocer, I divided the remainder among 27 persons ; find the share of each person.

4. Make out a bill for the following : 12 bars of soap, each weighing 3½ lbs., at 5½d. per lb.; 164 lbs. of tea, at 30s. per dozen pounds ; 12 packets of candles, each containing 6½ lbs., at 11½d. per pound.

5. What is the cost of 3 cwts. 3 qrs. 14 lbs., at 16s. 8d. a ton ?

6. Find the value of 4·790625£, and reduce 8 yds. 9 in. to the decimal of a mile.

7. How far can 48 tons be carried for the money paid for carrying 36 tons 144 miles ?

8. $\frac{1}{3}(\frac{1}{3} + \frac{2}{3}) + \frac{1}{3}(\frac{1}{3} + \frac{2}{3}) - \frac{1}{2}(\frac{1}{3} + \frac{2}{3})$ of £1 ; $\frac{7}{8}$ poles + $\frac{3}{8}$ yards + $\frac{3}{16}$ feet (linear measure).

EXERCISE CCLXV.

1. Divide .025 by 500, and 22500 by .00015.
2. Simplify $\frac{1}{4} \left(\frac{4\frac{1}{2} \text{ of } 6\frac{2}{3}}{7\frac{2}{3}} \right) \times \frac{3\frac{2}{3} - 3\frac{1}{3}}{3\frac{2}{3} + 2\frac{1}{3}}$ of £182 7s. 5d.
3. Find what £222 12s. 11d. will amount to in 7000 days, at 2 shillings per cent. per week simple interest.
4. What will it cost to paper a room 21 ft. 5 in. long, 18 ft. 7 in. broad, and 10 ft. high, with paper 25 inches broad, which costs 7d. per foot ?
5. If 6 men can do a piece of work in 30 days of 9 hours each, how many men will it take to do ten times the amount if they work 25 days of 8 hours each ?
6. Reduce 5 cwt. 1 qr. 13 lbs. 9 oz. to the decimal of a ton.

EXERCISE CCLXVI.

1. Simplify $2 \times \frac{\frac{28}{131} - \frac{14\frac{2}{3}}{943}}{7\frac{1}{3}} - 1\frac{1}{207}$ of $51\frac{1}{3}$ of $10\frac{7}{20}$ of $\frac{5}{19}$ of $\frac{1}{18}$.
2. Find the G. C. M. of 169037 and 66429, and the L. C. M. of 44, 48, 52, 96.
3. Divide 7.73682 by 101.4, and reduce 0.363 of £2 1s. 3d. to the decimal of 0.72 of £3 6s.
4. A cistern without a lid, whose floor and walls are $1\frac{1}{2}$ in. thick, is 5 ft. 3 in. long, 3 ft. 7 in. wide, and 2 ft. $5\frac{1}{2}$ in. high, in its internal dimensions. Find its internal surface, and the cost of painting the same at 4d. per square foot.
5. Find the square roots of 1522756 and $9\frac{47}{121}$.
6. Two chronometers which are precisely together on a certain day at noon are at the same instant, on the next day, 2.4 seconds apart ;

supposing the slower one to be correct, find the true value of a second as shown by the faster.

7. Find the present value of £91 17s. 6d., due in two years, at 5 per cent. compound interest.

8. If the cost of printing a book of 320 leaves, with 21 lines on each page, and, on an average, 11 words in each line, be £19, find that of printing a book with 297 leaves, 28 lines on each page, and 10 words in each line.

9. How should I affect my income by selling out from the $1\frac{1}{2}$ per Cents at $47\frac{1}{4}$, and investing in the $3\frac{3}{8}$ per Cents at 99?

EXERCISE CCLXVII.

1. Subtract one hundred and seven thousand and ten from twenty million ten thousand one hundred and one. Divide the result by twenty-five.

2. A tax-collector took at one house £1 0s. $1\frac{1}{2}$ d., at another £21 1s. 6d., at a third £6 8s. $0\frac{1}{4}$ d., at a fourth £1 17s. $5\frac{1}{4}$ d.; on returning home his pocket burst, and all the money he had collected was scattered on the ground; he picked up £30 7s. $0\frac{1}{4}$ d. Did he lose any money? if so, how much?

3. If £102354 14s. $8\frac{1}{4}$ d. be divided equally amongst 93 persons, how much will each receive?

4. Add together $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$. Find the value of $(4\frac{2}{3} + \frac{7}{2})$ of $(\frac{7}{2} + 1)$.

5. Find by practice the value of 1232 things at £1 3s. $4\frac{1}{2}$ d. each?

6. Divide 210720·6 by ·2107206 and by 42·06. What decimal fraction is £1 16s. 11d. of £33 4s. 6d.?

7. If 32 horses eat 96 bushels of corn in 21 days, for how many days will 66 bushels feed 7 horses?

8. If 3 ducks are worth 4 chickens, and 3 geese are worth 10 ducks, find the value of a goose, a pair of chickens being worth 4s. 6d.

9. What is the difference between interest and discount? Find the simple interest and amount of £63 5s. 9d. for $10\frac{1}{2}$ years, at $3\frac{1}{2}$ per cent.

10. A tank 20 ft. 9 in. long, 15 ft. 7 in. wide, and 6 ft. 4 in. deep ; find how much water it will hold in cubic feet and inches ?

11. A person invests £1365 in the 3 per Cents at 91 ; he sells out £1000 worth of stock when they have risen to $93\frac{1}{2}$, and the remainder when they have fallen to 85. How much does he gain or lose by the transaction ?

EXERCISE CCLXVIII.

1. The Mint buys silver for the purpose of coining seventy-four million eight hundred and sixty-seven thousand five hundred florins ; but when three-fourths of the florins have been finished the Mint is ordered to coin the rest of the silver into half-crowns. How many half-crowns will there be ?

2. Divide 570021 by 77 by *short* division, explaining how you obtain the remainder.

3. The weights of the Bow Bells are respectively : 2 tons 13 cwts. 0 qr. 25 lbs. ; 1 ton 14 cwts. 2 qrs. 6 lbs. ; 1 ton 6 cwts. 0 qr. 13 lbs. ; 1 ton 1 cwt. 0 qr. 23 lbs. ; 16 cwts. 0 qr. 4 lbs. ; 13 cwts. 2 qrs. 22 lbs. ; 12 cwts. 0 qr. 7 lbs. ; 10 cwts. 0 qr. 0 lb. ; 9 cwts. 1 qr. 5 lbs. ; and 8 cwts. 3 qrs. 7 lbs. Find their total and also their average weight.

4. Find by practice the cost of 7 tons 15 cwts. of iron at £7 16s. per cwt. ?

5. Simplify $\frac{384}{672}$; $\frac{9\frac{2}{3} - 7\frac{2}{3}}{61}$; and $3\frac{1}{2} - 1\frac{7}{8} + 4\frac{5}{12} - 2\frac{1}{3}$.

6. A and B join in giving a picnic, each paying for the guests he invites. A invites fifteen and B ten. The whole cost is £6 18s. $6\frac{1}{2}$ d. On the day, B pays for the carriages for the whole party at 2s. 6d. per head, and A pays all the other expenses. How must they afterwards settle accounts with one another ?

7. Divide 4.05 by 2.7 ; 40.5 by .0027 ; and .00405 by .00027.

8. Reduce £1 3s. $11\frac{3}{4}$ d. to the decimal of £5, giving the most correct answer to 4 places of decimals.

9. Make out a bill for the following goods shipped to New York, together with the charges upon them : Irish linen, 475 yds., at 3s. 4d. per yard ; black cloth, 37 yds., at £1 0s. 6d. per yard. Charges : Packing, £1 19s. 1d. ; shipping, £4 7s. 8d. ; insurance and commission on £130 at $2\frac{1}{2}$ per cent.

10. Find the discount, at $4\frac{1}{2}$ per cent., on £587 18s. 9d., due six months hence.

11. If 7 oxen can eat 3 tons of hay in a month, how long will it take 49 sheep to eat 35 tons, an ox consuming three times as much as a sheep ?

12. A room measures 16 ft. by 21 ft., and is 11 ft. high. There are one door, 7 ft. by 3 ft., and two windows, 8 ft. by 4 ft. Find the cost of papering it with paper 2 ft. wide, at $2\frac{1}{2}$ d. per yard ?

13. How many poles of fencing are required to enclose a square park, containing 832 a. 2 rds. 25 pls. ?

EXERCISE CCLXIX.

1. Find the product of the sum and difference of two hundred and thirty-eight thousand four hundred and twenty-eight, and one hundred and five thousand and sixty-nine.

2. Find by practice the rent of a farm containing 279 acres 3 roods 36 poles, at £2 11s. 8d. per acre.

3. The circumferences of the fore and hind wheels of a carriage are 13 ft. 9 in. and 16 ft. 6 in. respectively. How far has the carriage travelled when the fore wheel has made 768 more revolutions than the hind wheel ?

4. Simplify the fraction

$$\frac{(\frac{1}{2} + \frac{3}{4}) \text{ of } (\frac{2}{3} + \frac{1}{2}) + (\frac{1}{3} + \frac{2}{3}) \text{ of } (\frac{3}{4} + \frac{1}{2}) + (\frac{1}{2} + \frac{1}{3}) \text{ of } (\frac{2}{3} + \frac{3}{4})}{\frac{1}{2} \text{ of } (\frac{2}{3} + \frac{3}{4} + \frac{1}{2}) + (\frac{1}{3} + \frac{2}{3} + \frac{1}{2}) \text{ of } \frac{1}{2}}$$

5. State and prove the rule for the multiplication of decimal fractions.

Multiply 253·75 by 4·027, and divide the product by ·028189.

6. Find the value of

·345 of 9s. 2d. + $\frac{1}{8}$ of ·075 of £10 + ·05 of 1·125 of £1 13s. 4d. ;
and express the result as a decimal fraction of £50.

7. A man buys a certain number of eggs at two a penny, four times the number at 5d. a dozen, five times the number at 8d. a score, and ten times the number at 3s. 2½d. per hundred, and retails them at 6d. a dozen ; what profit does he make per cent. ?

8. A decimetre is equivalent to 3·937 inches, and a cubic decimetre of water weighs one kilogramme. If a cubic inch of water weigh 252·45 grains, express a kilogramme in pounds avoirdupois correct to within the one-thousandth part of a pound, 7000 grains being equal to one pound avoirdupois.

9. What sum of money will amount to £699 13s. 2·4d. in two years, reckoning compound interest for one year at 4 per cent., and for the other at 3½ per cent. per annum ?

10. A man saves every year £150, and invests it at the end of the year at 5 per cent. compound interest. Find the amount of his savings at the end of the fourth year.

11. The area of a square cricket-field is 9 acres 3 roods 8·16 poles. A running path of the uniform width of 3·9 yards is constructed close to the boundary of the field, at a cost of 4d. per square yard, and the remainder of the field is laid down in turf at a cost of 5s. 6d. per 100 square yards. Find the total cost of preparing the field.

12. A person having a certain sum of money to invest, finds that an investment in a railway preference 5 per cent. stock at 117½ will yield him £29 more interest annually than an investment in the 3 per Cents Consols at 92½ ; how much money has he to invest ?

SPECIMEN PAPERS SET BY THE LONDON UNIVERSITY
FOR MATRICULATION.

EXERCISE CCLXX.

1. State the rule for finding the greatest common measure of two numbers. Find the greatest common measure of 2793 and 7980, and the L. C. M. of 16, 90, 91, 280, and 455.

2. Simplify $\frac{\frac{1}{3} + \frac{4}{5} - \frac{8}{15}}{\frac{1}{3} - \frac{2}{5} + \frac{9}{15}}$, and find the value of

$$\frac{\frac{1}{3} \div \frac{1}{2}}{\frac{2}{3} \text{ of } \frac{5}{6} \div 10\frac{1}{2}} \times \frac{1\frac{1}{2} \text{ of } 4\frac{1}{6}}{6\frac{1}{2} \text{ of } 5\frac{1}{3}} \text{ of } £1.$$

3. Divide 23·78 by 62·5, and 6400 by ·04096, and reduce 3 hrs. 42 min. 39 sec. to the decimal of a year.

4. The rate of interest being 7 per cent., what is the discount on a sum of £1356 13s. 4d. due 3 months hence? and what is the interest on the same sum for 9 months?

5. The length of a rectangular piece of ground is twice its breadth; its area is 30479·805 square feet; find its length and breadth.

6. If 81 gallons of water will fill a cistern 4 ft. 4 in. long, 2 ft. 8 in. broad, and 1 ft. 1½ in. deep, how many cubic inches are contained in a pint?

EXERCISE CCLXXI.

1. Simplify $\frac{8\frac{3}{4} - 7\frac{3}{4} + 5\frac{3}{4} - 4\frac{1}{2}}{13 - 11\frac{9}{10} + 10\frac{7}{10} - 9\frac{1}{10}}$ of $\frac{1}{11}$ of 365.

2. Reduce $\frac{1}{170}$ to a recurring decimal.

3. Reduce the recurring decimal ·00054̄ to a fraction.

4. If a fraction be expressed by a decimal, in what cases will the decimal be non-recurrent? Can every recurring decimal be obtained from a vulgar fraction by the common process of division? If not, give an example to the contrary.

5. Find the square roots of $\frac{15729}{182329}$ of $11\frac{3}{7}$, and of $76\frac{1}{4}$ to 5 places of decimals.

EXERCISE CCLXXII.

1. A watchmaker obtains £1800 for the sale of the goodwill of his business and of 142 timepieces at the average price of £8 17s. 11d. per article; what does he get for his goodwill?

1. A bankrupt owes £7357 12s., and his assets amount to £3065 13s. 4d.; how much is this in the £?

3. Reduce to their simplest forms the fractions $\frac{1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}}{1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4}}$ and

$$\begin{array}{r} 2 \overline{) 3} \\ \underline{2} \\ 1 \\ 2 \overline{) 1} \\ \underline{2} \\ 1 \\ 3 \overline{) 4} \end{array}$$

4. Reduce to decimals $\frac{8}{25}, \frac{17}{256}, \frac{7}{161}$. Why does each of the first two fractions lead to a finite decimal, and the third to a recurring decimal?

5. Extract the square roots of 1245456 and $\frac{27\frac{9}{16}}{76\frac{9}{16}}$.

6. A cistern is fitted with three pipes, one of which will fill it in 48 minutes, the other in an hour, and the third in half-an-hour; how long will it take to fill the cistern when all three pipes are open together?

EXERCISE CCLXXIII.

1. If the carriage of 1 cwt. 12 lbs. for 105 miles be charged 3s. 10½d., find what will be charged for the carriage of 8 cwts. 1 qr. 24 lbs. for 245 miles.

2. From $\frac{5}{4}$ ths of a guinea take $\frac{7}{2}$ ths of a crown, and add $\frac{9}{16}$ ths of a shilling to $\frac{3}{2}$ nds of a sovereign.

3. Simplify $\frac{2\frac{1}{4} - 1\frac{1}{3}}{2\frac{1}{8} + 1\frac{1}{4}}$ and $\frac{5\frac{2}{3}}{7\frac{1}{2}}$ of $\frac{21\cdot25}{\cdot046875}$.

4. Find in how many years £452 10s. will amount to £644 16s. 3d. at 4½ per cent. per annum simple interest.

5. Extract the square root of 191810·713444, and find to 3 places of decimals

$$2\sqrt{3} - \frac{1}{2}\sqrt{12} + \sqrt{27}.$$

EXERCISE CCLXXIV.

1. Divide 4·068 by ·0018, and simplify

$$\frac{4\frac{2}{3} - 3\frac{1}{2}}{4\frac{2}{3} + 3\frac{1}{2}} \text{ and } \frac{2}{3} \left(\frac{2\frac{1}{4} + 1\frac{1}{2}}{3\frac{1}{2} - 1} + \frac{1}{2} \right)$$

2. Express £4 6s. 4½d. + $\frac{1}{8}$ of a farthing as a decimal of a £.
3. A grocer mixes 3 cwts. 15 lbs. of sugar at 14d. per lb., with 10 cwts. 10 lbs. at 4d. per lb.; at what price per lb. should he sell the mixture that he may neither gain nor lose?
4. A person having £1000 invests it in the 3 per Cents at 92, and pays a broker $\frac{1}{2}$ per. cent. on the stock purchased. After 3 years he sells at 95, and again pays $\frac{1}{2}$ per cent. brokerage. What amount of interest did he receive, and what did he gain on the whole?
5. Find the value of $\frac{\sqrt{2} + 1}{\sqrt{2} - 1} + \frac{\sqrt{2} - 1}{\sqrt{2} + 1}$ and extract the square root of 32·14 to four places of decimals.

EXERCISE CCLXXV.

1. Prove the rule for dividing one fraction by another, and find the value of $\frac{.05 \times .05 \times .05 + 1}{1.05}$ and 428571 of 1 min. 17 sec.
2. Divide £26 3s. 3d. between 3 persons so that their shares may be to one another in the proportion of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.
3. Extract the square root of 17 as far as four places of decimals.
4. A square plot of ground is one-fifth of a square mile in extent; find to the nearest inch the length of one of its sides.
5. A room is half as long again as it is broad, and contains 412½ sq. yds.; find its length and breadth.

EXERCISE CCLXXVI.

1. Find the value of 7 cwts. 3 qrs. 21 lbs. at £9 13s. 4d. per cwt.
2. Find the cost of painting the four walls of a room which is 32 ft. 4 in. long, 15 ft. 8 in. broad, and 11 ft. 6 in. high, at 3s. per square foot.
3. State the rule for the division of one decimal fraction by another. and divide 1.55 by .00125 and .00062 by 1.28.
4. A person invests £3580 in the 3 per Cents when they are at

$89\frac{1}{2}$; find his annual income after paying income-tax of 6d. in the £.

5. Extract the square root of $384524\cdot01$. Find the value to four places of decimals of $\frac{\sqrt{3}}{\sqrt{3} + \sqrt{2}}$.

EXERCISE CCLXXVII.

1. Find the value of

$$\frac{15\frac{3}{4} - \frac{1}{3} \times \frac{1}{8}}{\frac{1}{2} \times 23\frac{1}{3} + \frac{3}{8}} \text{ and of } \frac{7\frac{3}{8} \times 7\frac{3}{8} \times 7\frac{3}{8} - 27}{7\frac{3}{8} \times 7\frac{3}{8} - 9}.$$

2. Reduce the fraction $\frac{196-27}{23667}$ to its lowest terms. Of all the odd numbers intermediate between 1000 and 2000, which two have the G. C. M., and what is it?

3. Reduce to decimals $\frac{11}{313}$ and $\frac{7}{8}$. Find the continued product of $102\cdot5$, $1\cdot025$, $\cdot010225$, and the quotient of $4\cdot8$ by $\cdot00016$.

4. A corn dealer bought wheat at £2 1s. 3d. per quarter, which he subsequently sold at £2 9s. 7d. per quarter, and made a profit of £277 10s. 6d. upon the transaction; how many quarters did he buy and sell?

5. Find the value of $\frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}$ to three places of decimals.

EXERCISE CCLXXVIII.

1. Prove that the value of a fraction is not altered by multiplying its numerator and denominator by the same number, and reduce $\frac{3327}{23897}$ to its lowest terms, and $\frac{2}{15}$, $\frac{7}{25}$, $\frac{8}{50}$, $\frac{8}{8}$, to their least common denominator.

2. Find the value of $\frac{\frac{1}{40} + \frac{8}{27} + \frac{64}{125}}{\frac{1}{4} + \frac{1}{9} + \frac{1}{25} - \frac{1}{18}}$, of $\cdot00003125 \div \cdot02048$ and of $\cdot02048 \div \cdot00003125$.

3. What fraction is one week seven hours twelve minutes of the time from January 1st. 1800, to February 26th, 1864, both days

inclusive? Find a decimal of an acre which differs from a square foot by less than one thousand-millionth part of an acre.

4. Prove the rule for finding the value of a circulating decimal, and reduce the reciprocals of 99999 and 100001 to circulating decimals.

5. State the rule for extracting the square of a vulgar fraction, and find the square root of $\frac{8757}{85533}$.

PAPER SET BY SCIENCE AND ART DEPARTMENT.

EXERCISE CCLXXIX.

1. 14 tons 3 cwts. of copper, at £92 15s. per ton; 12 tons 12 cwts. of spelter, at 35s. 10d. per cwt.; 3 tons 5 cwts. of tin, at 78s. 9d. per cwt.; coal consumed, 14 tons at 14s. 3d. per ton; loss of metal in casting $\frac{1}{30}$; labour equal to one man for 31 days, at 4s. 9d.; other expenses reckoned at £125. What is the cost per ton to the nearest shilling?

2. Reduce to its lowest terms the following:

$$\frac{528 \text{ tons } 13 \text{ cwts. } 3 \text{ qrs. } 27 \text{ lbs. } 1 \text{ oz.}}{674 \text{ tons } 6 \text{ cwts. } 1 \text{ qr. } 2 \text{ lbs. } 1 \text{ oz.}}$$

3. A passenger train going 41 miles an hour, and 341 ft. long overtakes a goods train on a parallel line of rails; the goods train is going 28 miles an hour, and is 713 ft. long; how long does the passenger train take in passing the other?

4. Find the square root of 6005320036.

5. A B and C went into a joint-stock business, in which A invested £50, B £60, C £80. B withdrew his money after 10 months, but A and C continued in the business for 6 months longer, and then wound it up; the total profit was found to be £355. How much did each receive?

6. A gallon of fresh water measures 277·271 cubic inches, and weighs 10 lbs. avoirdupois; a ton of sea water measures 35 cubic

feet ; what is the weight of a gallon of sea water in lbs. and decimals?
(Two decimal places.)

SPECIMEN PAPERS SET BY THE ROYAL COLLEGE OF
SURGEONS.

EXERCISE CCLXXX.

1. What number must be added to 57464 to make it exactly divisible by 429 ?
2. Multiply £74 17s. 8½d. by 297, and divide £824 1s. 10¼d. by 59.
3. Find the cost of $5367\frac{1}{2}$ gallons at 4s. 6d. per gallon.
4. Add together $2\frac{3}{8}$, $3\frac{8}{25}$, $7\frac{1}{2}$, and from $13\frac{1}{15}$ take $8\frac{37}{25}$.
5. Simplify $2\frac{7}{8} \times 7\frac{1}{2} \times \frac{3}{8}$ and $13\frac{2}{25} \div 8\frac{1}{5}$.
6. Express $2\frac{1}{2}$ as a decimal, and 1·071875 as a vulgar fraction in its lowest terms.
7. Divide 1·87 by ·0763 to three places of decimals.
8. A tank holds 5360 gallons of water ; find the weight of water in tons, &c. (A gallon of water weighs 10 lbs.)
9. Sea water contains $2\frac{1}{2}$ per cent. of salt; how much sea water would be required to obtain a ton of salt ?

EXERCISE CCLXXXI.

1. Write in words the number 4005672030 ; and also its product when multiplied by the number "Four thousand and thirty."
2. Divide 345678910457 by 4073 ; and if there be any remainder represent the quotient in the form of a mixed number.
3. Find the cost of 473 articles at £4 7s. 3½d. each ; and determine the whole profit, supposing the seller bought them at £3 19s. 2¼d. each, and incurred an expense of £29 3s. 4½d. on account of them.
4. Compound a mixture, 3 parts of which shall contain 4 oz. 3 drs. 4 grs. each of one ingredient ; 4 parts, 5 drs. 2 scr. 7 grs. each of

another; and 5 parts, 7 drs. 2 scrs. each of a third; and determine the weight of each $\frac{1}{12}$ th part of the mixture.

5. Add together $\frac{4}{5}$, $\frac{5}{16}$, $\frac{7}{20}$, $\frac{8}{25}$, and $\frac{19}{400}$; and simplify

$$\frac{4\frac{1}{5} + (\frac{3}{5} \text{ of } \frac{7}{16})}{(\frac{5}{8} \text{ of } \frac{7}{8}) - \frac{3}{8}}.$$

6. Express $41\frac{3}{88}$ as a decimal, and 3.2746 as a fraction.

7. Find the value of 3.45 of seven guineas; and reduce 7s. 8d. to the decimal of £15 7s. 2d.

8. Multiply together 2.345 and .002345, or their equivalent fractions; and divide $(2345)^2$ by their product.

EXERCISE CCLXXXII.

1. Collections made on Sunday at eight different places amounted to the following respective sums: £79 18s. $4\frac{1}{2}$ d.; £35 4s. $7\frac{3}{4}$ d.; £27 6s. 5d.; £68 17s. $7\frac{1}{4}$ d.; £56 9s. $6\frac{1}{2}$ d.; £97 13s. $3\frac{1}{2}$ d.; £84 15s. $9\frac{3}{4}$ d.; £65 18s. $7\frac{1}{2}$ d. How much was collected then and there altogether?

2. A man's balance at the bank was, at the beginning of this month, £457 12s. 5d., out of which the banker has since paid to his order sums amounting to £298 19s. $8\frac{1}{2}$ d.; what is his balance now?

3. What is the total weight of 29 parcels, the average weight of each being 3 cwts. 3 qrs. 14 lbs.?

4. At a pay-office the sum of £401 0s. 7d. was last week paid to persons who received £3 13s. 7d. each; how many persons were thus paid?

5. Of a certain kind of goods, 170 lbs. now cost as much as 204 lbs. did cost at this time last year, and an order has just been given for the same quantity as cost £47 10s. last year; what will be the amount of the bill?

6. A pedestrian $6\frac{1}{3}$ miles distant from home halted, and then walked in that direction, halting occasionally. He found that he had passed over $1\frac{1}{8}$ miles, $1\frac{1}{2}$ miles, $1\frac{1}{4}$ miles, and $1\frac{1}{3}$ miles between each halt. What fraction of a mile intervened between his last halting place and his home?

7. A plastic mass having been divided into 5 equal portions, 3 of

these were again worked together, and the resulting mass was then divided into 4 equal parts. If now three of these parts be again united, what fraction will this united mass be of the original? And what will be the weight of this united mass if that of the original was 16 oz. 5 drs. 2 scr. 10 grs.?

8. On May 25th, at 8 a.m., the height of the barometer at Yarmouth was 30·22 inches, while at Helder it was 30·14 inches; what is the difference (expressed in decimal parts of an inch) between these readings? Also express that difference as a vulgar fraction in lowest terms.

9. In Central Germany the rain-fall amounts in December to 17 twelfths of an inch, in June to 40 twelfths of an inch. Express the rain-fall in December as a decimal fraction of the rain-fall in June.

10. An assistant's salary is £30 14s. 7d. per quarter, and he has received in advance sums amounting to £14 15s; what fraction (in lowest terms) of his salary has he still to receive?

EXERCISE CCLXXXIII.

1. Write in words the following: 25678, 200001, and 3040506. Add these together, and subtract from the sum of them five hundred and five thousand five hundred and ten.

2. If an income of £371 pays income-tax £10 16s. 5d., what is the amount of the tax per £; and what has an income of £500 to pay?

3. Reduce 5 leagues 2 furlongs 70 yards and 2 feet to inches.

4. Multiply 4 oz. 7 drs. 2 scr. 5 grs. by 3;
 9 oz. 7 drs. 1 scr. 10 grs. by 4;
 4 lb. 1 oz. 5 drs. 1 scr. 10 grs. by 17;

and supposing these quantities to represent three several drugs which are compounded together, find what part the first quantity is of the whole.

5. Define a fraction. Distinguish between proper and improper, between simple and compound, fractions.

6. Add the fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$, $\frac{9}{10}$, and divide their sum by $\frac{2}{3}$, reducing the result to its lowest terms.

7. Find the value of $\cdot 2$, $\cdot 02$, $\cdot 002$, $\cdot 0002$ respectively of a £. Add the four decimals together, and obtain the corresponding fraction to their sum in its lowest terms.

8. Divide a legacy of £5404 10s. 6d. between the London, Guy's, and the Middlesex Hospitals, in the proportion of 3 to the first, 2 to the second, and 1 to the third named.

9. The half of a medical student's expenses are incurred for his board and lodging. The half of this sum (the former half) his clothes and journeys cost. A fifth part of the same sum goes for other personal expenses; and the remainder (£21 1s. 6d.) his college fees amount to. Determine the whole amount, and the weekly average of his cost to his friends.

EXERCISE CCLXXXIV.

1. Multiply £10 8s. 8½d. by 680, and divide the result by 43.
2. If 1s. 3d. be the value of a superficial foot of land in the City of London, how much is an acre worth?
3. Find the least common multiple of 28, 45, 54, and 63; and reduce $\frac{12893}{14873}$ to its lowest terms.

4. Reduce to a simple fraction

$$\frac{2\frac{7}{8} + \frac{3}{8} \text{ of } 9\frac{3}{4} + 3\frac{1}{2}}{117\frac{3}{8} - 106\frac{1}{4}} \times \frac{1\frac{2}{3} \text{ of } \frac{3}{8} \text{ of } 21}{23} \text{ of } \frac{3\frac{5}{8}}{5\frac{3}{8}}.$$

5. Divide £17 2s. 9d. by $11\frac{5}{2}$; and find the difference between $\frac{7}{8}$ ths of a guinea and $\frac{9}{16}$ ths of 13s. 4d.

6. Of what sum of money is $3\frac{1}{2}$ guineas seven-thirteenths?

7. If a grain of gold make 70 square inches of gold leaf, find the weight of gold required to gild a cube whose side is 8 ft. 1 in.

8. Genuine sovereigns have 9167 parts of pure gold in 10,000. Some counterfeit sovereigns lately offered at the Bank have only 8138 parts. Find the value of one of these sovereigns.

9. Multiply $1\cdot\dot{2}\dot{7}$ by $2\cdot3\dot{6}$. Divide $2\cdot52$ by $\cdot 0012$, and $\cdot 108$ by $14\cdot4$.

10. Express a mile in metres, a metre being equal to $39\cdot371$ inches.

11. There are four partners in a business. The senior partner has 7 shares, the second 5, the third 3, and the junior partner 1 share. If the profits are £1205, how much will each partner receive?

EXERCISE CCLXXXV.

1. Find the difference between 23457 fourpenny pieces and 4000 florins.

2. How many years are there in 8640000 seconds?

3. If I have a mixture of teas weighing 1260 lbs., of which 100 lbs. were purchased at 3s. 4d. a pound; 260 lbs. at 4s. 6d. per pound; 400 lbs. at 2s. 8d. per pound; what did I give per pound for the rest, supposing the whole mixture cost me £228 10s.?

4. Add $\frac{1}{3}$ of £1 2s. 6d.; $\frac{2}{3}$ of £3 1s. 5d.; and $\frac{1}{4}$ of £5 10s. 0d. together.

5. If, on a straight road, stones be placed at intervals of 50 feet, and a measuring tape of 15 yards be used; how often will the end of the tape coincide with a stone in a distance of one mile?

6. Find the value of $1.25 + 2.5 - 1.75 + 3.05 - 1.025$.

7. Multiply 1.025 by 25.255, and divide the result by .0255.

8. Reduce 2s. 6 $\frac{1}{2}$ d. to the fraction of 3s. 8d., and 5s. 4d. to the decimal of 6s. 8 $\frac{1}{2}$ d.

9. Divide 120 lbs. into quantities having the ratio 1, 2, 3, 4; and 240 lbs. into the ratios of $\frac{1}{1}$, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.

10. Find the value of $\frac{5\frac{1}{2} \div \frac{2}{3}}{(1\frac{1}{2} \text{ of } \frac{4}{9}) \div 10\frac{1}{3}} \times \frac{\frac{1}{2} \text{ of } \frac{2}{4}}{2 - (\frac{1}{4} \text{ of } \frac{1}{3})}$.

EXERCISE CCLXXXVI.

1. What number taken from sixty-eight million forty-two thousand and thirty-five will leave eighty-four thousand and seven?

2. 16257 railway tickets were sold at a station; $\frac{1}{3}$ of which were 9d. each, and the rest 4d. each; what was the amount received for the tickets?

3. Multiply £117 9s. 6½d. by 731.
4. A farmer bought a number of sheep for £97 10s., at £1 17s. 6d. a head ; some of them died, he then sold all the others at £2 4s. 6d. each, and on the whole gained £2 12s. 6d ; how many died ?
5. Simplify the expressions :
 - (i.) $23\frac{5}{14} + 2 - 25\frac{3}{8} + \frac{17}{6}$.
 - (ii.) $\frac{13\frac{3}{4} + \frac{7}{6} - \frac{7}{6} \text{ of } 2\frac{5}{8}}{1\frac{1}{2} - \frac{2}{3} \text{ of } 5}$.
6. If $\frac{3}{4}$ ths of a ton of an article sells at £1 18s. 7½d., how much of it would amount to £1 1s. 5½d. ?
7. Find, by practice, the value of 860 cwts., at £3 3s. 6½d. per cwt.
8. Reduce 1s. 4d. to the fraction of £2 ; and reduce the result to a decimal.
9. Find the value of .1125 of £2, and of 3.27 of 12s. Divide 166.9773 by 5.439, and 4600 by .032.
10. Dry gelatin has been found to contain carbon, hydrogen, nitrogen, and oxygen, in the proportion of 10.01, 1.294, 3.67, and 5.026 respectively ; what is the percentage of nitrogen, and how much carbon is there in a cwt. of the substance ?

EXERCISE CCLXXXVII.

1. The digit in the units' place of a certain number is 3 ; that in the hundreds' place, 4 ; and that in the ten-thousands' place, 5. It includes no thousands, nor tens. Set it down in figures, and multiply it by fifteen thousand and forty.
2. Multiply £9 16s. 8¾d. by 507 ; and 8 oz. 7 drs. 2 scr. 16 grs. by 29.
3. Find the G. C. M. of 189, 252, 441 and 2205.
4. Obtain the L. C. M. of 2, 5, 33 and 1496.
5. Thirteen poor people receive a shilling a week from a certain charity. Seven others receive five shillings a quarter ; and five others thirteen shillings and fourpence a year. The sum at the disposal of the charity is fifty pounds. Determine the annual amount to be otherwise distributed.

6. Simplify $\frac{2}{3}$ of $\frac{5}{7}$ of $\frac{35}{81}$, and subtract the result from the sum of $10\frac{1}{2}$, $3\frac{2}{10}$, and $7\frac{3}{4}$.
7. Express 19 lbs. 5 oz. as a fraction of 3 qrs. 12 lbs. 9 oz.
8. Reduce the fractions $\frac{5}{10}$ and $\frac{2}{5}$ to decimals. Explain, generally, from what sort of fractions circulating decimals arise.
8. Reduce £2 13s. 4 $\frac{1}{2}$ d. to the decimal of £15.
10. A certain drug costs 1s. 4d. an oz. ; another costs 15s. 6d. a lb. ; and a third 2s. 8d. a dr. If these are compounded in the proportion of 4 grs. of the first, 16 grs. of the second, and a scruple of the third, what will be the cost of the mixture per oz. ?

EXERCISE CCLXXXVIII.

- Find the continued product of $87 \times 56 \times 409$.
- Multiply 5 oz. 7 dwts. 13 grs. by 56 ; and £27 14s. 7 $\frac{1}{2}$ d. by 584.
- Divide 18 cwts. 101 lbs. 8 oz. by 77 ; and £5429 12s. 3 $\frac{1}{2}$ d. by 783.
- Express 864275 inches in miles, yards, &c.
- Add together $12\frac{4}{15}$, $8\frac{7}{24}$, $5\frac{37}{60}$; and from $112\frac{2}{11}$ take $75\frac{13}{110}$.
- Express $2\frac{8}{5}$ as a decimal, and 1·0132 as a fraction.
- Divide 7 by 47·29 to four places of decimals.
- Which is greater $1\frac{2}{3} \times 2\frac{5}{8}$ or 018×216 ?
- If a cubic foot of ice weighs 57 $\frac{3}{8}$ lbs., how many cubic feet of ice will weigh a ton ?
- If soldiers on the march take 33 steps of 32 inches in 16 seconds, how many miles an hour will they march ?

EXERCISE CCLXXXIX.

1. Add together—

a.	roods.	pls.	sq. yds.
41	2	17	14
27	1	31	27
53	3	23	18

and subtract from their sum 22 a. 35 pls.

2. The following quantities of five different drugs are mixed in the concoction of a gross of medicinal draughts, viz. :—

oz.	drms.	scr.	gr.
2	3	0	17
4	7	2	5
7	5	1	14
1	4	2	18
5	1	1	0

Determine the weight of mixed drugs in each draught.

3. Multiply 81 hhds. 2 kilds. 17 gals. by 86 ; and divide the result by 27.

4. Find the difference of cost of coal during the half-year from Michaelmas to Lady-day (26 weeks), on account of a rise in price from 21s. 6d. to 37s. a ton, to a person who burns on an average $12\frac{1}{2}$ cwts. a week.

5. Find the value of

$$(i.) 2\frac{1}{2} + 3\frac{1}{3} + 4\frac{1}{4} + 5\frac{1}{5}.$$

$$(ii.) 6\frac{1}{3} \text{ of } 4\frac{1}{2} - 2\frac{1}{4} \text{ of } 3.$$

$$(iii.) \frac{7\frac{1}{9} \text{ of } 5\frac{8}{9} + 2}{3\frac{1}{4} \text{ of } 2\frac{1}{4} - 1}.$$

6. Find the value of

$$(i) \frac{7}{11} \text{ths of } £2 \text{ 6s. 9d.};$$

$$(ii) 6\frac{1}{3} \text{ of } £723 \text{ 4s. 10d.};$$

and reduce 1s. $8\frac{1}{2}$ d. to the fraction of £1.

7. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of £1 to the decimal of £5 12s. 6d. Multiply 714285 by .013, and give the result in the form of a fraction in its lowest terms.

8. A and B ride a bicycle race, the former maintaining an average speed of 14 miles an hour through the whole distance of 240 miles. B has an accident, which delays him half-an-hour, and causes that, when A reaches the journey's end, he is 27 miles off. Determine B's average speed.

EXERCISE CCXC.

1. A man died in 1873, aged 87 ; his son died in 1837, aged 18 ; how old was the father when his son was born ?

2. Simplify : (i.) $\frac{4009}{5064}$, (ii.) $\frac{2\frac{1}{4} \times 1\frac{7}{11}}{2\frac{1}{4} - 1\frac{7}{11}}$.
3. Express $\frac{7}{8}$, $3\frac{7}{125}$, $\frac{1}{64}$ as decimals ; add them together as fractions and as decimals ; and show that the two results are equal.
4. Multiply $\cdot 0726$ by $9\cdot 008$, and divide $2\cdot 35008$ by $\cdot 0576$.
5. Express 262 yds. 1 ft. 10 in. as a decimal of 1 mile, and $0\cdot 36875$ oz. in dwts. and grs.
6. Find the value of $1579\frac{1}{2}$ at 2s. $9\frac{1}{2}$ d. each, and of 17 gallons $3\frac{1}{2}$ pints at 13s. 8d. per gallon.
7. How much per cent. is $1\frac{1}{2}$ oz. per lb. ; and how much per lb. is 15 per cent. ?
8. A mixture is compounded of three substances, in the proportion by weight of 39·1, 14, 48, and there is $\frac{1}{2}$ oz. of the first ; how much is there of the 2nd and 3rd, and what is the weight of the mixture ?

EXERCISE CCXCI.

1. Write in words 700325896, and express in figures six hundred and six millions and ninety-six.
2. Divide £19 15s. 5d. between two men so that one may have half as much again as the other, and reduce the less share to the fraction of £9 17s. $8\frac{1}{2}$ d. in its lowest terms.
3. Add together $\frac{3}{5}$, $\frac{9}{10}$, $\frac{1}{4}$, and $\frac{8}{21}$.
4. Simplify $\frac{7\frac{3}{4} - 6\frac{1}{8} + \frac{5}{24}}{3\frac{5}{12} - 2\frac{3}{16} + 5\frac{1}{18}}$.
5. Multiply $57\cdot 064$ by $\cdot 00625$, and divide $365\cdot 248$ by $\cdot 0125$.
6. Reduce £9 7s. 8d. to the decimal of £11 14s. 7d., and 3 a. 2 rds. 16 pls. 8 yds. to the fraction of 4 a. 2 rds. 0 p. 10 yds., in its lowest terms.
7. A man spends £10 11s. 9d. a week ; how much does he spend in a leap year ?
8. Find the total cost of the following articles : $42\frac{1}{2}$ yards of carpet, at 5s. 6d. a yard ; 80 pieces of room paper, at 4s. $6\frac{1}{2}$ d. a piece ; and 24 lbs. 8 oz. of tea, at 3s. 8d. a pound.

EXERCISE CCXCII.

1. Multiply three millions and three by one hundred and fifty thousand three hundred and five. Express the result in words.
2. Divide £345723 19s. 6½d. equally among 19 persons, giving the remainder, if any, for the poor box. What will each have?
3. Coal having risen in price from 23s. to 35s. a ton, show that the difference to a poor man, who buys his coal by 7 lbs. at a time, is, for each purchase, exactly $\frac{2}{30}$ ths of a penny.
4. Add together $\frac{2}{7}$, $\frac{3}{11}$, and $\frac{4}{21}$. From the result subtract $\frac{1}{15}$.
5. Simplify $\frac{2 + 5\frac{1}{7} - 3\frac{2}{3}}{1 - \frac{3}{7} + 2\frac{2}{15}}$.
6. Multiply .00273 by 3000.456, and divide their product by .08.
7. Reduce 3s. 7½d. to the decimal of £5; and 5 lbs. 2 oz. to the decimal of 2½ tons.
8. One side of a street is numbered by odd numbers in order ranging from 1 to 313. How many houses are there? What is the number of the middle house?

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EXERCISE CCXCIII.

1. Calculate the cost of 16 cwt. 3 qrs. 13 lbs. at £32 13s. 4d. per ton.
2. Find the G. C. M. of 104811, 48825, and 68789.
3. Find the value of $2\frac{2}{3}$ of £3 14s. 2d. + $4\frac{1}{7}$ of 3 guineas + $\frac{1}{15}$ of £1 5s. 4d.
4. Convert $\frac{711}{1280}$ into a decimal, and $\frac{.75 \times .125 + .90625}{2.375 - .05}$ into a vulgar fraction.
5. Multiply 2.5 by .025, and write as vulgar fractions the lines of the multiplication.

6. Divide '98537 by 23·6 to four places of decimals, and write the remainder as a vulgar fraction in its lowest terms.

7. What shall I save on the dozen of wine, if, instead of buying it bottled at 24s. the dozen, I buy a cask containing 26 dozen for £25 12s. 5d., and bottle it myself, corks and bottles costing 2s. a dozen ?

8. If 16 men can do a piece of work in 13 hrs. 20 min., how many men will do one-half as much again in 5 hrs. 20 min. ?

9. Find the difference between the simple and the compound interest on £2000 for 3 years at $2\frac{1}{2}$ per cent.

10. If I buy £100 stock, which pays 7 per cent., for 119, at what price can I afford to sell it at the end of the year, so as not to lose, if money in the open market fetches 5 per cent. ?

EXERCISE CCXCIV.

1. Divide one million three hundred and twenty-two thousand and ninety-nine by twenty-four hundred and seventeen.

2. Subtract the product of 16, 24, and 37, from that of 18, 24, and 42.

3. If $15\frac{1}{4}$ yds. of silk cost £5 14s. $4\frac{1}{2}$ d., what is the price per yard ?

4. Divide £1851 13s. $1\frac{1}{2}$ d. by 72, and prove the result.

5. Out of a chest containing 237 sovereigns, 25 half-sovereigns, 17 crowns, 98 half-crowns, and 23 shillings, is taken a sum equal to £57 14s. 6d. ; how much money remains in the chest ?

6. Add $\frac{1}{12}$, $\frac{1}{24}$, $\frac{1}{8}$, $\frac{1}{6}$; and multiply the sum by $1\frac{3}{4}$.

7. What is the number of which five-eighths is equal to $26\frac{1}{4}$?

8. If the average produce per acre be 29 bushels $3\frac{1}{2}$ pecks, what will 325 acres produce ?

9. A coach, travelling 9 miles an hour, runs a certain distance in 11 hrs. 36 min., but a train does the same distance in 5 hrs. 13 min. 12 sec. ; what is the rate of the train ?

10. A clerk puts by every week three-tenths of his weekly salary ; but at the end of the year spends two-thirds of his savings ; how long will he take to save a full year's salary ?

EXERCISE CCXCV.

1. Out of 800 soldiers, 170 are 5 ft. 9 in. in height, 340 are 5 ft. 10 in., 210 are 5 ft. 11 in., and the rest are 6 ft.; what is the average height of the men?

2. Find, by practice, the value of $1275\frac{3}{4}$ yds., at 2s. $3\frac{1}{2}$ d. per yard; and of 21 cwt. 1 qr. 10 lbs., at £6 4s. 4d. per cwt.

3. If 112 yards of cloth, 29 inches wide, cost £20 6s., what will be the cost of 147 yards of the same cloth, 25 inches wide?

4. Find the order of magnitude of $\frac{9}{14}$, $\frac{11}{15}$, $\frac{3}{7}$ of $2\frac{1}{5}$, $2\frac{1}{4} \div 4\frac{2}{5}$.

5. Add together: $\frac{3}{8}$ of $\frac{1}{4}$ of $11\frac{1}{8}$; $2\frac{1}{2}$ of $\frac{11}{8}$ of $\frac{3}{8}$; and $\frac{2}{15}$ of $\frac{3}{7}$ of 147 and find the value of $13\frac{1}{8} - 29\frac{3}{8} + 41\frac{5}{8} - 15\frac{7}{8}$.

6. Find the cost of covering the floor of a hall, 120 ft. by 80 ft., with matting $1\frac{1}{2}$ yards wide, at 4s. 6d. a yard.

7. Express $\frac{27}{148}$ as a decimal; and find the value of £2·3875, and of 3·125 of 15s. 6d.

8. Add together 2·34, 4·6, 7·021; and divide 8·7967 by ·727.

9. Find the square root of 120409, and of $5\frac{1}{2}\frac{3}{8}$.

10. What is the difference in income from investing £22910 in the India Five per Cents at 114, or in the New Three per Cents. at 90 $\frac{3}{4}$?

11. Three men subscribe £4600: A subscribes £400 more than B; and B £300 more than C; they gain £345. Find what each subscribed, and their shares of the gain.

12. If a clock was right yesterday at noon, and had gained 5 minutes at 5 o'clock in the afternoon, what is the right time when it strikes 12 o'clock to-day?

EXERCISE CCXCVI.

1. Divide £3467 17s. $1\frac{1}{2}$ d. by 29; and £4126 18s. 9d. by 70.

2. What is the rating on £316, at 2s. $8\frac{1}{2}$ d. in the £.

3. If 120 men finish a work in 35 days, how soon will 150 men finish it?

4. If the duty on 50 packages, each weighing 128 lbs., is £33;

what is the duty on 73 packages of the same material, each weighing 98 lbs. ?

5. Find, by practice, the value of 7865 bushels, at $10\frac{1}{2}$ d. a bushel ; and of 102 cwts. 3 qrs. 8 lbs., at £1 19s. 8d. per cwt.

6. Find the interest of £3756 for $3\frac{1}{2}$ years, at $4\frac{1}{2}$ per cent.

7. Find the greatest and least of the fractions $\frac{17}{40}$, $\frac{7}{12}$, $\frac{71}{123}$.

8. Add together $\frac{3}{8}$, $\frac{9}{25}$, $\frac{27}{125}$, $\frac{81}{625}$; and add $\frac{2}{3}$ of $\frac{5}{8}$ of $17\frac{1}{20}$ to $\frac{2}{3}$ of $\frac{4}{11}$ of $17\frac{3}{4}$.

9. Find the difference between

$$£24 \text{ 5s. } 4\frac{1}{2}\text{d.} \times \frac{5}{23}, \text{ and } £39 \text{ 0s. } 10\frac{1}{2}\text{d.} \div 4\frac{5}{8}.$$

10. Express $\frac{19}{125}$ as a decimal ; and find the value of £1'8375.

11. Divide 5'4841 by '317 ; and '54841 by 31'7.

12. If tea, which is sold for 2s. 8d. per lb. in town, costs 3s. 6d. per lb. in the country, how many pounds must be bought in town to defray expense of railway ticket, 4s. 2d., and clear half-a-crown ?

EXERCISE CCXCVII.

1. Multiply 9040856 by 50607 ; and divide 27372420 by 738.

2. Divide £3917 19s. 8d. by 208 ; and prove the result by multiplication.

3. Reduce 182214 inches to miles ; and 315 half-guineas to half-crowns.

4. Multiply 7 lbs. 8 oz. 16 dwts. 13 grs. by 9 ; and divide 3 days 5 hrs. 42 min. by $2\frac{1}{2}$.

5. Find the sum of $\frac{3}{8}$, $\frac{4}{9}$, $\frac{11}{18}$, $\frac{5}{27}$, 8 ; and the product of

$$\frac{5\frac{1}{2}}{2\frac{1}{2}}, \frac{1\frac{7}{8}}{\frac{3}{4}}, \frac{\frac{3}{4}}{3\frac{1}{2}}.$$

6. What fraction of £4 14s. 5d. is £1 5s. 9d. ?

7. If 12 men, working 10 hours a day, can excavate a tunnel in 18 days, how many hours a day must they work to do it in 15 days ?

8. What will be the rent of 1 a. 2 rds. 8 pls. of land, if 3 acres are let for £9 5s. ?

9. Find, by practice, the value of 5 cwt. 2 qrs. 21 lbs., at £2 7s. 6d. per cwt.

EXERCISE CCXCVIII.

1. What is meant by "numeration"? Explain by an example. Divide two hundred and seventy-five million eight thousand and fifty by thirty thousand and five.

2. Define a "multiple" of any number; also a "common multiple," and the "least common multiple" of any two or more numbers. Determine the L. C. M. of 12, 15, 35 and 560.

3. If with a capital of £1500 I gain £140 in eight months, in what time with a capital of £546 should I gain £45 10s.?

4. State and explain the rules for (i.) the multiplication, and (ii.) the division of fractions.

$$\text{Multiply } \frac{7\frac{3}{4}}{9\frac{7}{8}} \text{ of } \frac{2}{3} \text{ by } \frac{5}{7} \text{ of } \frac{13\frac{4}{11}}{23\frac{3}{8}}.$$

$$\text{Divide } \frac{4}{5} \text{ of } \frac{1\frac{3}{4}}{1\frac{3}{4}} \text{ by } \frac{2}{3} \text{ of } 2\frac{5}{13}.$$

5. What fraction of £12 are $\frac{3}{4}$ of a guinea, $\frac{1}{8}$ of a florin, and $\frac{5}{8}$ of a farthing, respectively?

Express 4 fur. 2 ft. as a fraction of a mile.

6. Find the value of a French metre in Cremonese feet, if 12 of the latter be = 14 English feet, and the metre be = $39\frac{37\frac{1}{2}}{1000}$ English inches.

7. Prove that every cipher affixed to the left of a decimal fraction diminishes its value tenfold.

Reduce $7\frac{3}{8}$, $1\frac{7}{13}$, and $7\frac{23}{137}$ to decimals; and divide each result by 1000.

8. Find the value of £5346, 458 cwt., and 972916 mile.

9. Extract the square root of 182493081, $\frac{4}{5}$, and $1383\frac{2}{3}$.

10. If I buy £1400 stock in the New Three per Cents at $92\frac{3}{8}$, and pay $\frac{1}{8}$ per cent. brokerage, what does it cost me? and what will be the annual interest on my outlay?

EXERCISE CCXCIX.

1. Multiply six hundred millions four thousand and sixty-two by three millions four hundred thousand five hundred and three; and divide the result by sixty thousand and five.

2. In a street there are 154 houses. Of these, 23 have three families, 14 have four, and the remainder two residing in each. Supposing each family to include five persons, what is the population of the street?

3. How many persons may receive the sum of 4s. 4d. by the equal distribution of £537 11s.?

4. If, a person's yearly income being £145 3s. 4d., he gives in charity 1s. 6d. a week, and places in the bank 1s. 6d. a day for future use, what may be his daily expenditure, in order that he may keep just free from debt?

5. How many revolutions will the wheel of a carriage, which is 4 ft. 5 in. in circumference, make in 3 miles 5 furlongs?

6. Reduce $3\frac{1}{2}$, $\frac{4}{5}$ of $10\frac{3}{8}$, and $\frac{2\frac{1}{2} + 4\frac{3}{8}}{5\frac{3}{4} - 3\frac{1}{2}}$ to fractions with a common denominator. Add them together, and give the result in its simplest form.

7. Five-thirteenths of an estate cost £3547 5s. 7½d.; what is the value of the whole?

8. If the above estate be again sold for £10470 2s. 5d., what will be the gain per cent.?

9. Obtain the continued product of 35·7, 3·57, and ·357; and divide the result by ·0357.

10. How many bricks 9 in. long and 3 in. deep will be required for a wall 450 ft. long, 6 ft. high, and the width of a brick thick?

EXERCISE CCC.

1. Add together 230405607, 340506, 40005707, and 4030200000; and subtract 3900201499 from the sum. Write down the result in words.

2. Multiply £3457 17s. 4½d. by 75; and determine the number of farthings in the result.

3. Find how many years, of 365 days 6 hours each, there are in 4378234789 seconds.
4. Find by practice the amount of an officer's salary for 317 days at £1 13s. 4½d. a day.
5. If a man can walk 4 miles 2 furlongs 37 poles in an hour, in what time will he walk 15 miles 7 furlongs 4 yards?
6. Add together the fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{4}{5}$, and $\frac{7}{8}$; and multiply the result by 210.
7. Prove that the sum of the fractions $7\frac{1}{2}$ and $5\frac{1}{4}$ is equal to six times their difference.
8. What fraction of 1 cwt. is 3 qrs. 15 lbs.? and what 2 dwts. 3 gra. of 1 oz. troy?
9. After a certain examination, 20 boys in a school obtain a prize, 40 more are registered as in the first class, and the remainder (=two-thirds of the whole) are placed in the lower classes; how many boys are there in the school?

EXERCISE CCCI.

1. Find, by practice, the value of 8 qrs. 5 bush. $3\frac{1}{4}$ pks., at 9s. 3d. per bushel.
2. What fraction of 15s. is $1\frac{1}{2}$ of £2 - $\frac{2}{7}$ of 6 guineas?
3. What is the sum, $1\frac{1}{4}$ of which is £1 13s.?
4. If a person with a capital of £750 gains £30 in eight months, what will he gain with a capital of £800 in 5 months?
5. Divide .6 by 7.5, and 17.7632 by .0896. Reduce $\frac{1}{3}$ of £1 11s. to the decimal of 15s. 6d.
6. Find the value of .27 of $1\frac{1}{2}$ of £19 17s. $5\frac{1}{2}$ d.
and of $.175 + \frac{.2}{.3} - \frac{1}{2 \text{ of } 1\frac{9}{11}}$.
7. The present value of £50 15s. $5\frac{3}{4}$ d., due in 2 years and 8 months, is £45 6s. 8d.; find the rate per cent. (reckoning simple interest).
8. What interest per cent. is derived from investing money in the $3\frac{1}{2}$ per Cents at 84?

9. A ship which cost £9600 is wrecked; what did a person lose who possessed $\frac{3}{8}$ of it, the ship being insured for £95 per cent. of its real value?

10. Find the square root of 5'4'.

11. A contributed £600 to the partnership firm of A and B for 5 months, and received $\frac{2}{3}$ ths of the whole profit; B's share of the capital was £500. How long was B's money in the business?

EXERCISE CCCII.

1. Multiply 15 a. 3 rds. 2 pls. by 792; and reduce 9806 sq. ft. to sq. poles.

2. A tea-dealer mixes 42 lbs. of tea, which cost him 2s. $1\frac{1}{2}$ d. per lb., with 12 lbs. at 2s. $5\frac{1}{2}$ d. per lb.; at what price per lb. must he sell the mixture, in order to realise a profit of £1 5s. 3d.?

3. Express in its simplest form

$$\frac{3\frac{2}{3}}{4\frac{1}{4}} - \frac{3\frac{1}{4} - \frac{5}{8}}{3\frac{1}{3} + \frac{5}{8}} + 12\frac{7}{18}.$$

4. Add together $\frac{2}{3}$ ths of £4 2s. 6d. and $\frac{3}{4}$ ths of 5 $\frac{3}{4}$ guineas. Divide £4 14s. $10\frac{1}{2}$ d. by $2\frac{1}{4}$.

5. How many yards of cloth may be bought for £5 10s., if $2\frac{1}{2}$ yards cost 5s. 4d.?

6. Find, by practice, the weight of 650 coins, each weighing 5 dwts. 9 gra.

7. In what time will £333 6s. 8d. amount to £400 16s. 8d. at $4\frac{1}{2}$ per cent., simple interest?

8. Express in figures, nineteen and three thousandths. Divide 2·64 by 37·5, and 66 by ·0375.

9. Find the value of 2·45 of 5 guineas; and reduce 3s. 4d. to the decimal of £1 6s. 8d.

EXERCISE CCCIII.

1. Express 3500306021 in words. Multiply 73497 by 30080. Divide 744178193 by 954.

2. Reduce 3 oz. 2 dr. 1 sc. to grains ; and 147 half-crowns to guineas.
3. Take 7 fur. 32 pls. $4\frac{1}{2}$ yds. from 13 fur. 3 pls. $2\frac{1}{4}$ yds.
4. Multiply £5 6s. $7\frac{1}{2}$ d. by 423.
5. Divide £365 1s. $11\frac{1}{4}$ d. equally among 39 persons.
6. Add together 1, $34\frac{1}{2}$, $41\frac{3}{11}$, $\frac{3}{14}$.
7. Multiply $\frac{34}{3}$ of $2\frac{1}{3}$ by $\frac{8\frac{3}{4}}{19}$.
8. Reduce $2\frac{1}{3}$ of half-a-guinea to the fraction of £1 15s.
9. A house is let at 50 guineas a year ; what amount is due for 10 weeks 3 days ?
10. If the railway fare of 2 persons for 32 miles be 8s., how much will be the fare of 3 persons for 20 miles ?
11. Find, by practice, the value of 338 lbs. at 9s. $7\frac{1}{2}$ d. per lb.

EXERCISE CCCIV.

1. A walks $3\frac{1}{2}$ miles an hour, and B 4 miles ; they walk towards one another from two places 10 miles apart ; how far has each walked when they meet ?
2. Simplify

(i.) $8\frac{5}{12} - 5\frac{1}{3} + 6\frac{2}{3} - 7\frac{1}{6}$.

(ii.) $\frac{5\frac{2}{3} - 3\frac{1}{3}}{5\frac{2}{3} \times 3\frac{1}{3} - 1}$.

(iii.) $\frac{1}{7 - \frac{1}{7 + \frac{1}{4}}}$.
3. Divide 7·852 by ·325 ; take 2·037 from 5·123 ; and multiply 8·17 by 1·45.
4. Express $17\frac{1}{2}$ miles in kilometres, taking a kilometre as equal to 1093·6 yards.
5. What is the present worth of a bill for £235 14s. 8d., due 90 days hence, discounted when the bank rate is 4 per cent. ; and what would be lost if the rate were raised to $4\frac{1}{2}$ per cent. ?
6. What income is derived from investing £630 7s. 6d. in the India 4 per Cents at $102\frac{1}{2}$; and what is the rate of interest per cent. on the money invested ?

7. Two numbers are in the ratio of 17 : 25, and their difference is 104 : find them.

8. A lead ore, which cost £18 7s. 6d. per ton, yields 84 per cent. of crude lead containing a small quantity of silver, 40 oz. to the ton : the silver is worth 4s. 6d. an ounce, and the refined lead £20 per ton. Find the profit on smelting a ton of ore.

9. Find the number of tons of stone required to build a break-water, 25 ft. broad at the top and 75 ft. at the bottom, with a mean height of 20 ft. ; length 2240 ft. ; the stone weighing 180 lbs. per cubic foot.

10. A tramway costs £94,300 ; and there are 8 cars, making on an average 12 journeys a day, and carrying 32 passengers each time for a fare of 2d. ; and the expense of working is £150 a month. Find the rate per cent. of profit made.

EXERCISE CCCV.

1. Find the average age of a class of 15 boys, of whom 4 are 15 years 3 months of age, 5 are 15 years 1 month, and the rest are 14 years 10 months.

2. Add together $\frac{2}{3}$, $\frac{1}{4}$, $\frac{107}{108}$; and from $308\frac{25}{108}$ take $84\frac{57}{108}$.

3. Find the difference between $3\frac{1}{2}$ of £1 5s. 6d. and $4\frac{1}{2}$ of 18s. 4d.

4. Multiply 3·046 by ·0027, and divide 1·05 by 42·76 to 4 places of decimals.

5. Take £8 7fl. 4c. 16m. from £12 4fl. 24c. 11m. ; and express the result in £ s. d.

6. Find the cost of $827\frac{1}{2}$ things at 13s. $5\frac{1}{2}$ d. each, and of 5 a. 3 rds. 37 pls. at £31 7s. 6d. per acre.

7. If the weight of equal quantities of iron and coal are as 72 : 13 what weight of coal will occupy the space of 5 tons of iron ?

8. Find the rate of interest per cent. at which £540 will amount to £580 10s. in $2\frac{1}{2}$ years.

9. How much must be invested in the 3 per Cents at $90\frac{1}{2}$, to produce an income of £165 12s. 6d. ?

10. Copper ore is worth £13 19s. 3d. per ton, and yields $14\frac{1}{2}$ per cent. of pure copper ; find the price of the copper per ton.

EXERCISE CCCVI.

1. Write in words 3407062 ; and in figures, eighty-two million forty-five thousand and seventeen.

2. Multiply 5 a. 2 rds. 13 pls. by 759 ; and divide £2517 18s. 3d. by 867.

3. Find the least number exactly divisible by 156, 185, 224, and 240.

4. Add together $\frac{5}{12}$, $\frac{17}{28}$, $\frac{11}{32}$, $\frac{8}{35}$; and find the value of $\frac{9}{20} \times \frac{3}{14} \times \frac{35}{37} \times \frac{16}{105}$.

5. Express 29 yds. 8 in. as a fraction of a mile ; and find the value of $2\frac{7}{12}$ of £3 5s. 6d.

6. Find the value of 657 things at 15s. $5\frac{1}{2}$ d. each ; and of 7 cwts. 3 qrs. 24 lbs. at £6 10s. 8d. per cwt.

7. How many yards at 4s. $9\frac{1}{2}$ d. per yard are worth $3127\frac{1}{2}$ yds. at 7s. $6\frac{1}{2}$ d. per yard ?

8. A train, which started at 8.30 in the morning, has gone 60 miles at 11 o'clock ; what is its rate per hour, and when will it reach a station 70 miles further ?

EXERCISE CCCVII.

1. On a railway $1209\frac{1}{2}$ miles long, the receipts in one week of one year were £96168 9s., while in the corresponding week of the year before the receipts were £87055. Calculate to three places of decimals the increase per cent. in the average receipts per mile for that week.

2. The expense of draining, &c., a district of 9264 acres 3 roods 34 poles came to £9 18s. 8d. per acre ; find, by practice, the total expense.

3. To make a plan (or map) of the country between two stations 30 miles 1088 yds. 2 ft. 8 in. apart, it was found that a piece of paper 13 yds. 1 ft. 5 in. long was used ; what length of paper would be used in planning (on the same scale) the country between two stations 42 miles 1524 yds. 1 ft. 4 in. apart ?

4. If £248 10s. $10\frac{1}{2}$ d. be charged for a loan of £4370 for 13 months

how long would a loan of £10830 be lent for a charge of £331 13s. 4½d.?

5. For the last three years a tradesman's gains have been at the rate of 12½ per cent. per annum compound interest, and two years ago he was worth £9060 12s. What was he worth three years ago? What is he worth now?

6. A gentleman bought 4 per Cent. stock at 87½, and after receiving a half-year's interest on it, sold the stock at 85; what did he lose per cent. by these transactions?

7. Reduce $2\cdot0428125$ to a vulgar fraction in lowest terms. Also reduce $\frac{1}{12} - 3\frac{2}{3} + 5\frac{1}{12} - 1\frac{1}{2} + 4\frac{1}{8} - 2\frac{7}{10}$ to a vulgar fraction in lowest terms, and then reduce that fraction to a circulating decimal.

8. Multiply ·00307 by ·000702; then to the product add ·00022534486. Finally, divide the last result by ·091.

9. A sum of money is to be divided among 7 men and 12 boys, and 3 men are to receive as much as 4 boys. What fraction of the whole will be left when 5 of the men and 5 of the boys have received their shares? Also, if the sum to be divided be £21 9s. 4d., find each man's and each boy's share.

10. A French square metre contains 10·7643 Eng. square feet; find (to 2 places of decimals) the number of feet in the length of a metre.

EXERCISE CCCVIII.

1. On a railway 1209½ miles long, the receipts in one week of one year were £96168 9s., while in the corresponding week of the preceding year the receipts were £87055. Calculate the increase in the average receipts per mile per week.

2. Find, by practice, the value of 78956 articles at £0 7s. 8½d the dozen. Also the value of 301 cwts. 2 qrs. 16 lbs. at £6 6s. 7d. per cwt.

3. How many yards of material could be bought for £20 16s. 9½d. at the rate at which 937½ yards would cost £111 6s. 6½d.?

4. In French silver money 1 franc (or 100 centimes) is worth 9½d. English when silver is at 5s. the ounce. What sum of French money

is worth £262 12s. 8d. when silver is at 5s. $1\frac{1}{2}$ d. the ounce? (In the answer, neglect any fraction of a centime.)

5. Find the G. C. M. of 100110 and 31866. Also find the L. C. M. of 16, 18, 24, 32.

6. Reduce to vulgar fractions in lowest terms :

$$(i.) 2\frac{7}{24} - 1\frac{1}{18} + 5\frac{7}{32} - \frac{1}{6}, \quad (ii.) 8.95625.$$

7. Multiply 7.0707 by .0050505. Divide 64.97 by .089.

8. Find the sum which, at simple interest for 9 years at 5 per cent. per annum, would amount to £149 4s. 7d.

9. A dealer bought goods for £665, and gained 5 per cent. by selling them to another, who on his part lost 5 per cent. by re-selling them to a third. What did the third pay for the goods?

EXERCISE CCCIX.

1. The expenses of a temporary hospital were, for January, £238 17s. 2d.; for February, £297 9s. $5\frac{1}{2}$ d.; for March, £285 14s. $7\frac{1}{4}$ d.; for April, £178 17s. $8\frac{3}{4}$ d.; for May, £93 12s. 6d.; for June, £64 16s. $9\frac{1}{2}$ d. What was the total expense for these months?

2. A boy working a sum gave for the answer 4624 a. 1 r. $13\frac{1}{2}$ pls.; but the correct answer would have been 3946 a. 3 rds. $28\frac{1}{2}$ pls. Find the amount of his error.

3. How many bricks will be used in making a tunnel 3697 yds. long, if 2758 bricks are used for each yard?

4. The average worth of each of 647 packages was £89 17s. $5\frac{1}{4}$ d.; what was the worth of all of them together?

5. How many payments, each of £190 14s., can be made out of a fund amounting to £28065 7s. $3\frac{1}{2}$ d.? Again, what sum would remain after the payments were made?

6. A coach wheel made $1157\frac{1}{2}$ turns in going over 1382 yds. 1 ft. $8\frac{1}{2}$ in.; how many turns will it make in going over 266 yds. 1 ft. 1 in.?

7. From 1 lb. of metal 34 medals are struck, each worth 15s. 7d.; and from 1 lb. of the same metal there are struck 22 other medals; what is the value of each of these?

8. Find the sum of $42\frac{3}{8}$, $93\frac{5}{12}$, and $163\frac{5}{18}$. Then from that sum subtract $168\frac{7}{8}$. Also find the value of $2\frac{2}{3}$ of $\frac{1}{12}$ of $3\frac{1}{3}$ of £9 4s. $3\frac{1}{4}$ d.

9. Out of £126 17s. 6d., A is to receive £87 12s. 1d., and B and C are to share the remainder equally. Express B's share as a fraction (in lowest terms) of A's share.

EXERCISE CCCX.

1. Reduce $\frac{33\frac{3}{4}}{14430}$ to a decimal ; and divide the result by 8.
2. Simplify $\frac{\frac{9}{10} \text{ of } \frac{5}{21} + 3\frac{23}{42}}{\frac{3}{16} \text{ of } (12\frac{3}{4} - 8\frac{5}{8})} \div \frac{3\frac{1}{2}}{2\frac{5}{8}}$.
3. Find the value of $20\frac{1}{4}$ of £8 5s. $5\frac{1}{2}$ d. + $5\cdot03125$ s. - £678125.
4. Divide $\cdot82680048$ by $27\cdot432$.
5. Extract the square root of $\cdot9$ to three decimals, and raise $\cdot8$ to the 12th power, retaining only four decimals throughout the work.
6. Find the cost of 16 tons 6 cwts. 12 lbs., at £8 9s. 9d. per cwt.
7. A man sells $24\cdot65$ yds. of cloth for £36 19s. 6d.; his profit is the cost of 493 yds.; what was its amount, and the rate per cent.?
8. If $3\cdot75$ cwts. be carried 51 $\cdot6$ miles for £875, what weight should be carried 75 miles for £2625?
9. In what time will a sum of money double itself at $4\frac{1}{8}$ per cent. simple interest?
10. A person transfers his 5 per Cents stock at 115 to another of price $126\frac{1}{2}$. What rate of interest should this latter pay that his income may be unaltered?
11. What amount of the new stock (in No. 10) will he hold, if he transfers £1100 from the 5 per Cents?
12. A, B, C join their capitals, which are in the proportion of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, for trading. At the end of 4 months, A withdraws half of his capital; and after 8 months they divide £1056 of profits; what ought they severally to receive?

EXERCISE CCCXI.

1. A bankrupt pays 14s. 2d. in the pound. How much will a creditor receive for his debt of £1516 17s. 6d.?

2. Express in the form of a simple fraction

$$1\frac{7}{8} \text{ of } 1\frac{1}{2} \div \left(1\frac{3}{8} - \frac{14\frac{1}{2}}{28}\right).$$

3. Find the value of $6\frac{3}{4}$ of £24 16s. $4\frac{1}{2}$ d. + $\frac{3}{8}$ of 13s. 5d. - $\frac{7}{8}$ of 15s. 6d.

4. Express as a decimal

$$\frac{555}{1480}; \text{ and as a vulgar fraction } \frac{6 \times 2625}{3 \cdot 1875 - 2 \cdot 75}.$$

5. Write down the following products and quotients :—

$$\begin{array}{lll} (a) 1 \cdot 2 \times 1000; & (c) 12 \times 1 \cdot 20; & (e) 1 \cdot 2 \times \cdot 012; \\ (b) 1 \cdot 2 \div 1000; & (d) 12 \div 1 \cdot 20; & (f) 1 \cdot 2 \div 120. \end{array}$$

6. Express 3 cwts. 1 qr. 7 lbs. as the decimal of a ton.

7. If the wages of 12 men for 4 days amount to £29 14s.; how many men should work 11 days for £81 13s. 6d.?

8. What sum must be put out to simple interest at $4\frac{1}{4}$ per cent. to produce an amount of £1425 in 10 years?

9. At what price must the $4\frac{1}{2}$ per Cents be, to produce the same income as the 5 per Cents at £115? Find the income from an investment of £2346 in either stock.

10. A coal-dealer mixes in equal proportions two sorts of coal, worth 37s. and 21s. a ton respectively; he sells the mixed coal at 34s., and gives short weight by 10 lbs. in each sack of 2 cwts. What money does he cheat a customer of who orders 14 tons?

EXERCISE CCCXII.

1. Write in figures, ten million eighty-three thousand six hundred and eighty; and divide 9403781 by 3, 4, 5, in succession. Show the formation of the final remainder after the three divisions.

2. Write in words 3060574, and multiply it by 1407.

3. What will be the aggregate weight of 341 separate parcels each of which weighs 1 qr. 7 lbs. 4 oz.? (Work by practice, if you can.)

4. How much will remain over from a sum of £1000, after distributing equal portions, as large as possible, to each of 453 persons?

5. A tax of 9d. in the pound is levied on the rental of dwelling-houses, whose annual value is £27548687; what will the tax produce?

6. Find the least common multiple of 1932 and 1679.

7. Express in furlongs, poles, and yards, $\frac{1}{3080}$ mile.

8. Find the value of $\frac{1}{18} - \frac{2}{3} + 2\frac{1}{8}$.

9. What will the cost of 9131 cwts., at £1 4s. 3d. per cwt., amount to?

10. If the wages of 12 men amount to £29 14s., how many men ought to work for the same time for £81 13s. 6d.?

EXERCISE CCCXIII.

1. There were 207 wet days in a year, and the rainfall on 8 days was 0·57 inches, on 57 days 0·46 inches, on 126 days 0·15 inches, and on the rest 0·05 inches; find the whole rainfall for the year.

2. If 1 metre = 39·3708 inches, reduce 4 yds. $7\frac{1}{2}$ in. to the decimal of a metre.

3. Simplify $\frac{2\frac{1}{2} \times 2\frac{1}{2} - 1}{3\frac{1}{2} - 2\frac{1}{2}}$, and express the result as a decimal; and

find the value of $\frac{1}{2\sqrt{3} - \sqrt{5}}$ to three places of decimals.

4. If a furnace consume 14 tons of coals in $17\frac{1}{2}$ days, how much coal will be required for three such furnaces for 11 days?

5. What must be the depth of a cistern 14 ft. long by 11 ft. 6 in. broad to hold 17500 gallons? (1 gallon of water weighs 10 lbs., and 1 cu. ft. weighs 1000 oz.)

6. The Three per Cents are at $92\frac{7}{8}$; what sum must be invested to produce an income of £120, and how much is lost by selling out again when the stock has fallen $\frac{1}{8}$ per cent.?

7. A dishonest farmer mixes 5 per cent. of water with milk, which he sells to a milkman, who retails it, after adding 5 per cent. of water to what he receives; what per cent. of water is there in the milk retailed?

8. A and B have 14s. 6d. between them, A and C have 11s. 6d., and B and C have 13s. 4d.; how much has each?

9. A merchant sells goods for which he receives a bill at three months for £3450, by which he would have gained 15 per cent. ; but his customer fails, and only pays 11s. 7d. in the £. How much does he lose ?

10. The area of a circle is proportional to the square of its diameter. Now the diameters of a florin and a half-crown are in the proportion of 115 : 124, and the thickness of a half-crown is 0.046 inch. Find the thickness of a florin.

EXERCISE CCCXIV.

1. What is the least number which added to 78840 will make it exactly divisible by 4363 ?

2. A mail bag contains 15027 letters, each weighing on an average $\frac{1}{2}$ oz. ; find the weight of the bag.

3. Simplify (i.) $22\frac{3}{4} + 17\frac{1}{2} - 8\frac{5}{12}$,
(ii.) $(2\frac{3}{4} - 1\frac{1}{2}) \times (2\frac{3}{4} + 1\frac{1}{2})$.

4. Add together $\frac{2}{3}$ of 10s. 6d., $1\frac{2}{3}$ of 8s. 3d., and $\frac{3}{4}$ of 3d., and express the result as a decimal of 10s.

5. Find the value of 17 bales of 218 yards, each at 14s. $2\frac{1}{2}$ d. a yard ; but of which 3 bales were damaged, and sold only for half price.

6. A cistern is 18 feet long by 16 feet broad ; how deep must it be to hold as much as another 20 feet long, 15 feet broad, and 27 feet deep ?

7. If a man works 10 hours a day for his wages, how many hours a day ought he to work so as to take half the Saturday as a holiday, and get the same wages ?

8. Find the simple interest and amount of £416 2s. 6d. from April 2nd to May 9th, at $4\frac{1}{2}$ per cent.

9. If A advances £1500 for 9 months, and B £1200 for 6 months, what share of a gain of £1150 belongs to each ?

10. A house is rated at $\frac{2}{3}$ ths of its rent, and the rate at 5d. in the £1 is 18s. 9d. ; what is the rent ?

EXERCISE CCCXV.

1. Express one thousand seven hundred and forty-nine in Roman and in Arabic numerals.
2. Multiply 17 cwts. 2 qrs. 19 lbs. by 36, and by 93.
3. The receipts of a railway line 1388 miles long were £84806 16s. for a week ; find the average receipts per mile for a day.
4. Find by practice the value of (i.) 1147 things at 4s. 10½d. each, and (ii.) 211 qrs. 3 bush. at £2 14s. 8d. per quarter.
5. Add together $\frac{2}{3}$, $\frac{4}{5}$, $\frac{8}{12}$, and from $112\frac{2}{3}$ take $78\frac{4}{5}$.
6. If the thickness of a sovereign be $\frac{1}{16}$ th of an inch, what would be the height of a pile of 12672 sovereigns ?
7. If Indian corn is worth in England 43s. per 522 lbs., find the value of 1450 sacks of such corn, each sack holding 250 lbs.
8. If a man walks a certain distance in $12\frac{1}{2}$ hours at $3\frac{1}{2}$ miles an hour, how many miles an hour must he walk to complete the same distance in 50 minutes less ?
9. A bankrupt pays 13s. 8d. in the £ ; how much is paid on a debt of £118 10s. ?
10. A farmer rents a 10 acre field at £4 per acre ; he pays for farming expenses £17 10s., and for seed at the rate of £6 15s. an acre, and he gets crops worth £140 ; what does he gain, and at what rate per cent. ?

EXERCISE CCCXVI.

1. Express, by digits, the following numbers : Three billion forty-five million seven hundred thousand two hundred and four ; two billion seven hundred and three million five hundred and four thousand one hundred and eleven ; seventy million two thousand and one. Add them together, and subtract their sum from seventy billion fifty million and ten.
2. How many hours are there in 15 years of 365 days 6 hours each ?
3. How many packets containing $5\frac{1}{2}$ lbs. each can be made up from 3 cwts. 3 qrs. 17 lbs. ?

4. A merchant bought goods which cost him £973 15s. 6d. In one month he sold to the amount of £123 14s. 7d. In the next to that of £234 3s. 4d., and in the third to an amount equal to the two former. Supposing he had then a third part of his original purchase left, what profit had he made in the three months?

5. Define "simple interest." What is that of £723 14s. 6d. for $5\frac{1}{2}$ years at 6 per cent.?

6. My agent has sold goods for me to the value of £3257 15s. 9d.; what is his commission at 3 per cent.?

7. Define a "vulgar fraction." What do the numerator and the denominator respectively express? *e.g.* $\frac{4}{5}$, $\frac{1}{20}$.

8. Add together $\frac{2}{3} + (\frac{1}{12} \text{ of } 2\frac{2}{3}) + (\frac{2}{9} \text{ of } 6\frac{2}{3})$.

Multiply $31\frac{4}{5}$ by $(\frac{1}{11} \text{ of } \frac{1}{35})$, and $\frac{4\frac{1}{5} - 3\frac{7}{10}}{3\frac{3}{4} + 2\frac{7}{10}}$ by $7\frac{3}{4}$.

9. Reduce $7\frac{1}{2}$ d. to the decimal of 15s., and obtain the value of 00123 ton at 2s. 3d. an ounce.

10. Square 034203; and obtain the square root of 453.725 to five places of decimals.

11. Show, by a figure, that one square yard contains nine square feet.

One side of an oblong yard measures 12 ft. 3 in., and the cost of paving it at 1s. a square foot is £12 11s. $1\frac{1}{2}$ d.; find the length of the other side.

12. Nine boys have £4 3s. 7d. to divide between them. Each is to have one shilling more than the next younger boy. Determine the share of each, and the remainder.

EXERCISE CCCXVII.

1. Express in words the following numbers and their sum : 234500072, 3702040230, 50465007, 2001.

2. Seventeen equal bars of iron weigh 2 tons 15 cwts. 45 lbs.; what is the weight of each?

3. If 8 masons build 35 yards of wall in 2 days, how many yards will 115 masons build in the same time?

4. A manufacturer has 127 workmen, to whom he pays 18s. a week each ; and 85 others, to whom he pays £1 7s. 0d. each ; what is the whole amount of wages paid by him in a year ?

5. Which is greater, $\frac{1}{2}$ or $\frac{1}{3}$? Find their difference, and multiply it by $\frac{2}{15}$.

6. How many times are $\frac{3}{4}$ contained in $1\frac{1}{11}$; and $\frac{4}{5}$ in $3\frac{1}{5}$?

7. Reduce to a simple fraction :

$$\frac{3}{5} \text{ of } \frac{2}{3} \text{ of } \frac{4}{11} \text{ of } \frac{5}{6} \text{ of } \frac{7}{8} ;$$

and find the value of $\frac{2}{3}$ of £2 3s. 1½d.

8. Multiply 2·27 by ·01302 ; and obtain the value of 1·35 of a £.

9. Find the area of a square, the side of which is 14 ft. 2 in.

10. Obtain the amount of £35 16s. 5d., at 4 per cent. simple interest, for $4\frac{1}{2}$ years.

EXERCISE CCCXVIII.

1. Multiply 340567010 by 27013, and divide the product by 97.

2. Subtract the third part of £2000 16s. 6d. from £5000, and divide the remainder equally between 18 persons.

3. Multiply £52,736 4s. 7½d. by 25, and find the number of half-pence in the result.

4. Reduce 2 miles 3 fur. 17 yds. to inches.

5. Find, by practice, the value of 3 cwt. 2 qrs. 14 lbs. of sugar, at £2 11s. 4d. the cwt.

6. Subtract $\frac{4}{5}$ from $\frac{7}{8}$, and add the remainder to $31\frac{1}{2}$.

7. What fraction is (i.) $\frac{2}{3}$ of a £ ? and (ii.) £2 3s. 6d. of £55 5s. 6d. ?

8. A boy has four dozen of marbles. In one game he loses a third of them ; in another, a fourth of the remainder. How many has he then left ?

9. At the end of a term, two schools have respectively 105 and 80 boys. At the beginning of the next term, each is found to have diminished by one-fifth of its number. How many has the one school more than the other then ?

EXERCISE CCCXIX.

1. What is the expense of keeping 12 fires for 30 weeks, each fire consuming 4 cwts. 3 qrs. of coals per month, the price of a ton being £1 3s. 6d.?

2. Resolve 94248 and 105336 into their prime factors. Find the G. C. M. and the L. C. M. of these numbers; and reduce the fraction $\frac{94248}{105336}$ to its lowest terms.

3. Reduce $\frac{6\frac{3}{4}}{3\frac{2}{3} - \frac{3}{4 - \frac{2}{3}}}$ of 2s. 6d. to the fraction of a £.

4. Divide 1438·642 by 47·16; and 3·03 by 53·3.

5. Find the value of 1785 of 2s. - 04 of 2½ £ + 3·25½ of 11d. - 1153 of a shilling.

6. Express ($\frac{1}{12} + \frac{1}{15} - \frac{1}{27}$ of $2\frac{1}{10} + \frac{1}{24}$) of a guinea as a decimal of £2 9s.

7. Find the square root of 842·7409, and $9\frac{5}{11}$.

8. The sum of £1245 is invested in the 4 per Cents. at 84. How much money must be invested in the 3½ per Cents at 98 to produce the same income?

9. A and B are partners in a business, in which A has £4900, and B £1400; B, being the working partner, receives £6 per cent. of all the profit; the rest is divided in proportion to the capital. What does each receive of £450 profit?

10. The simple interest of a certain sum at 4½ per cent. for 2 years 4 months is £63 more than the simple interest of the same sum at 5 per cent. for 1 year 9 months. Find the principal.

EXERCISE CCCXX.

1. A number diminished by two-thirds of itself, when divided by 809, gives a quotient of 327, and a remainder 456; what is the number?

2. Divide 18 miles 2 fur. 31 pls. 3½ yds. by 54.

3. If the carriage of 9½ cwts. for a distance of 80 miles be 9s. 4d., how many miles should 6 tons 10 cwts. be carried for £1 15s.?

4. Subtract $1\frac{1}{2}$ of $\frac{3}{8}$ of $5\frac{7}{8}$ from $\frac{5}{8}$ of $4\frac{1}{2}$; and divide $1\frac{3}{8}$ by $\frac{3\frac{3}{4}}{4\frac{1}{4}}$ of $2\frac{3}{4}$.
5. Reduce 7s. $3\frac{3}{4}$ d. to the fraction of 10s. $5\frac{1}{4}$ d.; and find the value of $\frac{5}{8}$ of £2 9s. 4d. - $\frac{3}{8}$ of £4 + $2\frac{1}{2}$ of $\frac{3}{4}$ of a guinea.
6. Add together 4·395, ·0285, 511·45, 88·1465; and divide the sum by ·075. Also express $\frac{1\frac{3}{4}}{3 - 1\frac{1}{4}}$ as a decimal.
7. If 4 ozs. of tea cost ·5625s., what is the value of ·15625 cwt.?
8. Find the value of 357 cwts., at £3 7s. $2\frac{1}{2}$ d. per cwt., by practice.
9. What sum of money will amount to £428 5s. 6d. in $3\frac{1}{2}$ years, at $4\frac{1}{2}$ per cent. per annum?
10. A watch, which cost £4, was sold for £4 18s.; find the gain per cent.

EXERCISE CCCXXI.

1. Multiply one hundred and three million three thousand and five by thirty thousand six hundred and seven.
2. Multiply £34 17s. $5\frac{1}{4}$ d. by 219.
3. Divide £3056 8s. $10\frac{1}{2}$ d. into 53 equal sums. Also divide £6 18s. $9\frac{1}{4}$ d. by 7.
4. Reduce 378162 grains to lbs. troy.
5. If 3 cwts. 2 qrs. of rice cost £4 1s. 8d., what quantity can be bought for £1 8s. 4d.?
6. If 3 fires consume 65 cwts. of coals in 26 days, in how many days will 12 fires consume 4 tons?
7. Find, by practice, the value of 357 yds., at 6s. $9\frac{3}{4}$ d. per yard?
8. Add together $5\frac{1}{3}$, $4\frac{2}{3}$, $\frac{7}{12}$, $1\frac{5}{6}$, $\frac{1}{36}$.
9. Subtract $19\frac{4}{5}$ from $25\frac{4}{5}$; and divide the remainder by $35\frac{4}{5}$.
10. Express $\frac{2}{3}$ of $3\frac{1}{2}$ of £1 11s. 6d. as the fraction of £3.

EXERCISE CCCXXII.

- Find the cost of 1 ton 16 cwts. 3 qrs. at £1 10s. 2d. per cwt.
- Simplify $\frac{3\frac{1}{2} \text{ of } \frac{1}{2}\frac{1}{2} - \frac{7}{8}}{1\frac{7}{10} + \frac{1}{2}}$ and $\frac{.0071507}{.092}$.
- Find the value of $\frac{2}{3}$ of 6s. 8d. + $\frac{1\frac{1}{2}}{1\frac{1}{2}}$ of £2 3s. 9d. + $\frac{3}{10}$ of 2s. 1d. of £4 14s. 5d.
- Raise 1.035 to the 8th power, retaining only four decimal figures in the work ; and extract the square root of .3 to four places.
- Express 14s. 2d., 13s. 7d., 2s. 4 $\frac{3}{4}$ d. as decimals of £1 ; add the decimals, and convert the sum into £ s. d.
- If the interest on £653 13s. 4d. for 10 years amount to £392 4s., what should be that on £1961 for 2 years 10 months at the same rate ?
- Find the simple interest, or the discount, on £525 10s. for 2 years 74 days at 4 $\frac{1}{2}$ per cent. per annum.
- What is a perpetual annuity of £150 worth, reckoning interest at 4 per cent. ?
- A tradesman, who allows 15 per cent. discount for cash, adjusts his prices accordingly ; how much must he put on the price of an article worth £5 10s. 6d. ?
- If I buy 5 per cent. stock at 112 $\frac{1}{2}$ per cent., what rate of interest shall I get ? and what will be my income from an investment of £5000 ?

EXERCISE CCCXXIII.

- Multiply £4 13s. 3d. by 396 $\frac{7}{12}$.
- Simplify $4\frac{3}{10} - \frac{2}{3}$ of $5\frac{1}{2}\frac{1}{2} + \frac{1}{3\frac{1}{2}} - (2\frac{1}{2} + 1\frac{1}{2}) \div 18\frac{2}{3}$.
- Find the value of $\frac{2}{3}$ of 6s. 8d. + $\frac{1\frac{1}{2}}{1\frac{1}{2}}$ of £2 3s. 9d. + $\frac{3}{10}$ of 2s. 1d. of £4 14s. 5d.
- Express as decimals $\frac{119}{1750}$ and $\frac{89}{385}$.

5. Find the sum and the difference of '040404 and seventy-six thousand four hundred and sixteen millionths. Multiply the results, and divide the product by '3001. Write the quotient in words.

6. Express 17s. 6d., 12s. 9d., 3s. 4½d. as decimals of £1; add the decimals, and convert the sum into £ s. d.

7. What weight must be added to 12 cwts. 4 lbs. 6 oz. that it may be exactly sufficient for a number of equal parcels each weighing 2 lbs. 3 oz.?

8. Find the rent of 145 a. 3 rds. 16 pls. at £3 7s. 6d. per acre.

9. If, on dividing a bankrupt's estate, a creditor for £65 7s. 6d. receives £9 6s. 7½d., how much should another receive for his debt of £150?

10. Find the simple interest on £653 13s. 4d. for 2 years 10 months at 3 per cent.

EXERCISE CCCXXIV.

1. Find the sum and the difference of 76416 and forty thousand four hundred and four; multiply the results, and divide the product by 3001. Write the quotient in words.

2. How many pounds, shillings, and pence in 25685 fourpenny pieces? Multiply the answer by 60, and divide the product by 21. Exhibit the remainder clearly.

3. The aggregate weight of 617 parcels is 12 cwts. 5 lbs. 11 oz.; what is the average weight of each?

4. Express in their lowest terms $\frac{1875}{1896}$ and $\frac{2417}{12483}$.

5. Simplify $4\frac{3}{8} - \frac{2}{3} + 1\frac{1}{4} - \frac{23}{12} + 1\frac{1}{4}$.

6. Find the value of $2\frac{1}{2}$ of 4 lbs. 2 fur. 8 pls. $3\frac{1}{2}$ yds.

7. How many square feet, yards, and poles in 100000 square inches?

8. Find the cost of 20 dozen articles at 14s. 10½d. each.

9. If the price of coal rise from 24s. to 40s. a ton, what will be the expense for coal which now costs £18 8s.?

10. A piece of cloth apparently measures 18 yards, but the yard

measure used is $\frac{3}{16}$ inch too short ; what is the true length of the cloth ?

EXERCISE CCCXXV.

1. Write in words 450070024.
2. Multiply £1563 17s. 9 $\frac{1}{2}$ d. by 357.
3. Divide £27543 12s. 8d. by 352.
4. Find the number of days, hours, minutes, and seconds, in 1213459 seconds.
5. If 144 tons of coals cost £181 16s., what will be the price of 245 tons ?
6. Reduce $\frac{3}{4}$ of $\frac{1}{2}$ guinea to the fraction of £1 ; and reduce $\frac{667}{1108}$ to its lowest terms.
7. A person buys 4 cwts. 3 qrs. 14 lbs. of sugar at £2 16s. 8d. per cwt., and sells it at 8 $\frac{1}{2}$ d. per lb. ; how much does he gain or lose ?
8. If, after paying 7d. in the pound for income-tax on my income, I have £1632 18s. 10d. remaining, what had I at first ?
9. How much coffee at 1s. 10 $\frac{1}{2}$ d. per lb. must be given in exchange for 75 lbs. of tea at 2s. 6d. per lb. ?

EXERCISE CCCXXVI.

1. Find the weight of sugar I may obtain for £6 14s. 2d., if 25 cwts. 2 qrs. cost £59 10s.
2. Find, by practice, the value of 2 roods 19 poles 12 yds. of land at £80 13s. 4d. per acre.
3. Divide the sum of $\frac{2}{3}$, $\frac{4}{5}$, $\frac{3}{16}$, $\frac{7}{18}$, by $7\frac{5}{8}$, and find the value of $£\frac{2}{3} + \frac{2}{3}$ of 25s. + $\frac{3}{8}$ of 4d.
4. Find the value as a vulgar fraction of $\frac{.025 \times .25}{.0025}$, and reduce 2s. 3 $\frac{1}{2}$ d. to the decimal of £1 2s. 6d.
5. Find the time required that £420 put out to simple interest at 4 $\frac{1}{2}$ per cent. per annum, may amount to £798.

6. Find the values of $\cdot 159375$ of a £, and $\cdot 6875$ of a shilling, and express their difference as the decimal of a guinea.

7. A room is $12\frac{1}{2}$ ft. broad and $22\frac{1}{2}$ ft. long; what will it cost covering with carpet $\frac{3}{4}$ of a yard wide at 4s. 6d. a running yard?

8. If the cost of 750 soldiers for 12 days be £900, how long can 2000 soldiers be maintained for £3000 at the same rate?

9. A gold and a silver coin are respectively worth 2s. $6\frac{1}{2}$ d. and 1s. 11d. each; an amount of 100 guineas has to be paid with these coins, so that there shall be twice as many gold as silver coins employed; how many will be required of each?

EXERCISE CCCXXVII.

1. What is the value of $\frac{\cdot 00125}{\cdot 18}$, and the square root of $\cdot 0531118116$?

2. What sum at $4\frac{1}{2}$ per cent. simple interest will produce in $2\frac{1}{4}$ years an amount of £1233 8s.?

3. Reduce £3 11s. $9\frac{3}{4}$ d. to the decimal of £1; and find value of $\cdot 1825$ of £2 6s. 8d.

4. Reduce $\frac{\frac{4}{5} + \frac{7}{11}}{1 - \frac{4}{5} \text{ of } \frac{7}{11}} + \frac{\frac{1}{2} - \frac{4}{5}}{\frac{4}{5} - \frac{7}{11}}$.

5. Find square root of 250080·0064.

6. Three merchants invest respectively in a cargo the sums £5200, £3600, £2000; when sold, there is a profit of £1647. Find what each should receive, and at what rate per cent. the profit is.

7. If after deducting $12\frac{1}{2}$ per cent. from my money I have £525 10s. left, what had I at first?

8. What sum of money at $4\frac{1}{4}$ per cent. will produce the same income that £2700 does at $5\frac{1}{2}$ per cent.? Find the income, and how much must be given for the stock in the 3 per Cents at 90, necessary to produce the same yearly amount.

9. A is 2640 yards in advance of B; A runs 5 miles an hour, and B 6; in what time will B overtake A?

10. If 16·125 yards of cloth 1·375 yards wide cost 2·2 £, what would 45 yards, $\cdot 875$ yards wide, at the same price per square yard, cost?

EXERCISE CCCXXVIII.

1. A candidate having been examined in 15 subjects, gained the following numbers of marks : 95, 80, 86, 71, 74, 87, 92, 93, 125, 47, 65, 43, 115, 75, 76, 80. How many marks did he get altogether, and how many more must he have gained to have the full number of 1500 marks ?

2. A mass of wet clay weighed 76 tons 11 cwts. 2 qrs. 12 lbs., but when dried it weighed only 69 tons 15 cwts. 3 qrs. 16 lbs.; what weight of water was in the wet clay ?

3. If a railway carriage wheel turns 1689 times in going a league how many turns will it have made after it has travelled 3574 leagues ?

4. The average extent of each of 439 fields is 13 a. 2 rds. 15 pls.; what is the extent of all of them together ?

5. Certain persons had to subscribe £5 17s. 4½d. each to make up a total of £223 0s. 3d.; how many persons subscribed ?

6. An estate is left among three heirs; the first receives £5000, the second three-fourths of the share of the first, and the third five-sixths of the share of the second. What is the whole value of the estate ?

7. If 264 men can earn £480 12s. in a certain time, how many at the same rate could earn £229 4s. 6d. in the same time ?

8. If 31404 gallons of water can be raised to the height of 321 feet for a certain sum, how many gallons could be raised to the height of 428 feet for half the sum, reckoning the expense of raising the water at the same rate per foot per gallon in both cases ?

9. Add together $1\frac{7}{8}$, $3\frac{1}{2}$, $\frac{3}{20}$, and $2\frac{3}{16}$; and find the value of $1\frac{7}{8}$ of $3\frac{1}{2}$ of $\frac{3}{20}$ of $2\frac{3}{16}$ of 10s. 8d.

10. Towards a charitable purpose two persons each contributed £27 5s. 1½d., and a third contributed £42 16s. 7½d.; what fraction of the total was formed by each contribution ? (Express the answers in their lowest terms.)

EXERCISE CCCXXIX.

1. The value of land bought for some railways was £442165 5s. 10½d., being an average of £97 13s. 5½d. per acre; find the number of acres.

2. The valued rents of a parish are £5070 16s. 8d., and on this a rate of £405 13s. 4d. is to be paid; what will the rate be on a rent of £68 8s. 9d.?

3. If 24 sappers in $2\frac{1}{2}$ days can dig $139\frac{3}{4}$ yards of a trench, how many yards can 90 men dig in $1\frac{1}{2}$ days?

4. Find, by practice, the value of 43781 square yards of work estimated at 11s. 8½d. per square yard; also the value of 2705 oz. 13 dwts. 13 grs. of gold, valued at £3 17s. 10½d. per oz.

5. In what time will £712 10s. amount to £1136 8s. 9d. at $3\frac{1}{2}$ per cent. per annum, simple interest?

6. Reduce the fraction $\frac{29505}{27692}$ to its lowest terms. Find the G. C. M. of 238, 374, 442; also find the L. C. M. of 7, 14, 28, 42, 35.

7. Reduce $4\frac{2}{3} + 3\frac{2}{4} + 2\frac{1}{2} + 1\frac{5}{8}$ to a mixed number in its lowest terms, and to a decimal. Also reduce the product $4\frac{2}{3} \times 3\frac{2}{4} \times 2\frac{1}{2} \times 1\frac{5}{8}$ to a mixed number in lowest terms, and to a circulating decimal.

8. Multiply .052375 by .88; also divide .0042003 by 1.17. Then subtract the latter result from the former, and reduce the difference to a vulgar fraction in its lowest terms.

9. By selling goods for £773 10s. 3½d. a gain is made of $3\frac{1}{4}$ per cent. on their prime cost; find the prime cost.

EXERCISE CCCXXX.

1. A number of subscribers contributed in equal shares a sum of £14525 towards an enterprise which was afterwards abandoned. The money was returned to the subscribers after the expenses, amounting to £523 10s. 3d., had been paid out of the fund, and each of them received £538 10s. 4½d. How many subscribers were there?

2. Find the value of 3061 cwts. 2 qrs. 15 lbs. at £7 10s. 9d. per cwt.

3. A sum of £3362 12s. yields an annual income of £157 12s. 5½d.; what would £5310 17s. 4d. yield at the same rate?

4. If three engines, each of 520 horse-power, can lift $60\frac{1}{2}$ million

gallons of water to the average height of 260 feet by working for $57\frac{7}{24}$ days of 8 hours each, how many days of 11 hours each would be required to lift $49\frac{7}{10}$ million gallons of water to the average height of 104 feet by means of 2 engines, each of 832 horse-power?

5. A sum of money has for three years been accumulating at compound interest at the rate of $4\frac{1}{2}$ per cent. per annum, and now amounts to £24283 17s. 1d. Determine the sum, and calculate what its amount would have been at the same rate but at simple interest.

6. Three partners, A, B, and C, contribute £868, £700, and £672 to a speculation, and at the end of six months found their profits amount to £225 10s. Out of this they agree to take each of them a dividend of $6\frac{1}{4}$ per cent. on his capital, and to divide the remainder in proportion to their actual second-class railway travelling expenses. Now, for a certain number of days in each month, A has travelled 20 miles a day for $4\frac{1}{2}$ months, B 30 miles a day for 5 months, C 35 miles a day for 4 months. Determine what share of the £225 10s. each is to receive, and also what fraction his share is of the whole profits.

7. Reduce $12\frac{9}{16} - \frac{3}{8} + 14\frac{1}{4} - \frac{1}{10} + 3\frac{7}{8}$ of $\frac{2}{3}$ to the simplest form as a vulgar fraction in its lowest terms, and also as a recurring decimal.

8. Extract the square root of $3080\frac{1}{4}$, and the cube root of 9·528128.

9. The proceeds of the sale of $3\frac{1}{2}$ per Cents stock at $93\frac{1}{8}$ amounted to £6844 13s. 9d.; find the amount of the stock, and the clear annual income derived from it, deducting income-tax at 5d. in the £.

EXERCISE CCCXXXI.

- Find the value of 13 yds. 3 qrs. $3\frac{7}{8}$ nails, at 10s. 6d. per yd.
- Simplify $\frac{50\frac{1}{2}}{19\frac{2}{11}} \times \frac{2\frac{3}{4} - \frac{1}{2} + \frac{1}{8}}{3\frac{1}{2} + \frac{1}{4} - \frac{1}{2}}$
- Express as a vulgar and as a decimal fraction of $\frac{1}{11}$ acre,
 $\frac{11\frac{3}{8}}{100}$ sq. po. + $\frac{7}{4}$ sq. yd. + $5\frac{9}{10}$ sq. ft.
- Convert $\frac{711}{35100}$ into a recurring decimal, and find its square correctly to the fourth place of decimals.

5. Find the first two significant figures (not more) of the quotient of $\cdot 660375$ divided by $23\cdot 54$, and prove their correctness.

6. How many rods ($272\frac{1}{2}$ sq. ft.) of brickwork, $1\frac{1}{2}$ bricks thick (14 inches), will a million bricks, measuring $9 \times 4 \times 3$ inches, suffice for?

7. If by selling at £26 17s. 6d. I gain 25 per cent., how much shall I gain per cent. by selling at £28 13s. 4d.?

8. What is the value of the gold in an ornament weighing $13\frac{3}{4}$ dwts., of which $\frac{2}{5}$ are pure gold, if $\frac{1}{2}$ oz. of pure gold is worth £3 17s. $10\frac{1}{2}$ d.?

9. A person transfers his money from the Three per Cents at $91\frac{1}{2}$ to the Four per Cents. at 98; find the ratio of the new to the former income.

10. What annual payment will be sufficient to discharge a debt of £100, due in 10 years, with simple interest at 5 per cent.?

11. One cubic foot of water weighs 1000 ounces avoird., and 1 gallon contains 277·274 cubic inches; what must be the length of the side of a square tank capable of holding 2000 gallons, if the depth be 5 feet? and what is the weight (in pounds) of water in the full tank? (N.B., two decimals only required.)

EXERCISE CCCXXXII.

1. Explain the common system of notation by which ten symbols are sufficient to represent all numbers.

What decimal of £1 is $\frac{4}{5}$ ths of $2\frac{1}{3}$ th of 6s. 6d.?

2. Simplify the expression

$$\frac{89 \times (\text{£}28 \text{ 19s. 3d.}) - 143 (\text{£}6 \text{ 3s. 2d.}) + 57 (\text{£}45 \text{ 6s. 8d.})}{137};$$

and find out what is the least sum that should be added to the numerator in order to make the answer an integral number of six-pences.

3. A tradesman buys a hundredweight of coffee for £5, and sells it for £6 7s. 6d.; what is his gain per cent.?

4. Find, by practice, the value of 448 articles at £1 12s. $7\frac{1}{2}$ d. each.

5. Find the sum, difference, product, and quotient of $\cdot 78962$ and $\cdot 3$.

6. A man invested £2320 in a concern, and lost the first year 5 per cent. of his capital, next year he lost 2 per cent., and the third year he gained 9 per cent; what was the amount of his capital at the end of the third year?

7. Is the cube root of 11 or the fourth root of 21 the greater?

8. Find the value of

8·316 of an oz. + ·285714 of a dwt. — ·3037 of a lb. troy.

9. Find the price of 3 per cent. stock when an investment of £625 produces an income of £20 2s. 6d.

10. A quantity of tea has tea sweepings added to it so that the sweepings are $\frac{1}{3}$ th of the whole mixture; if the mixture be worth 3s. per lb. and the sweepings 6d. per lb., what is the exact value per lb. of the pure tea?

11. Find the simple interest of £960 12s. 6d. for 5 years 297 days at $3\frac{1}{4}$ per cent.?

12. What sum should be given for an annuity of seven yearly payments of £50, the first payment being due one year after the purchase, and money reckoned at 4 per cent.?

SPECIMEN PAPERS SET BY OXFORD AND CAMBRIDGE UNIVERSITIES.

EXERCISE CCCXXXIII.

1. Find the value of ·07 of £2 10s., and express the result as the decimal of a £.

2. If every soldier cost 1s. 6d. per day, what is the cost of a regiment of 860 for a year?

3. A, B, and C run a quarter of a mile race. A has 3 yards' start, B 2 yards. C gains one foot in 40 yards throughout on A, B gains 2 feet in 25 yards on A for the first 200 yards, after that loses one foot in 20 yards. What is the result of the race?

4. What length of carpet 3 ft. 6 in. wide will cover a room 18 feet

long by 16 feet broad, so as to leave a space one foot wide all round the room?

EXERCISE CCCXXXIV.

1. To lowest terms

$$\left\{ 1 + \frac{1}{3 + \frac{1}{3 + \frac{1}{3}}} \right\} \div \left(\frac{1}{3} + \frac{1}{11} \text{th of } 10\frac{2}{3} \right).$$

2. Find the value of $\frac{1}{180}$ th of a £ + $\frac{2}{15}$ ths of $\frac{2}{3}$ ths + $\frac{5}{42}$ nds of a guinea + $\frac{1}{2}$ nds of a penny.

3. Find the square root of 69169 and 1·8225.

4. Give the rule for (1) placing the point in the division of decimals ; (2) for reducing a circulating decimal to a vulgar fraction Divide ·02 by ·05, ·0005, and 50.

5. Reduce ·075 of a £ to a decimal of 4s. 6d., and 2 pls. 909 yds. 1 ft. 72 in. to the decimals of 1 acre 60 sq. yds.

6. A man buys eggs at $11\frac{1}{2}$ d. per dozen, and sells them at 2d. each; what does he gain per cent. ?

7. Nine men were engaged to dig a trench 3 ft. deep, $4\frac{1}{2}$ ft. wide, and 120 yds. long, in a certain time ; but before it was begun it was discovered that the trench must be 5 feet deep, 180 yards long, but only 4 feet wide. How many men must be employed that it may be finished in time ?

8. Find the simple interest on £387 10s. for $5\frac{1}{2}$ years, at $3\frac{1}{2}$ per cent.

9. What sum, if laid out in $3\frac{1}{2}$ per Cents for 6 years, will produce £28 17s. 6d. at simple interest ?

10. What is the cost of papering a room 14 ft. 6 in. long, 10 ft. 6 in. broad, 8 ft. high, with paper 2 ft. wide, at $1\frac{1}{2}$ d. per yard ?

EXERCISE CCCXXXV.

1. What is expressed respectively by the several digits in the number 893·254 ? Express in words 9087654321.

2. Find the value of 179 cwts. 3 qrs. 22 lbs. at £3 18s. 2d. per cwt.

3. Simplify the fractions

$$\frac{(\frac{3}{4} + \frac{4}{5} + \frac{6}{8}) \text{ of } \frac{7}{9}}{\frac{4}{5} \text{ of } (\frac{1}{2} + \frac{5}{8} + \frac{7}{9})}$$

and $\frac{1\frac{1}{2}}{7} \text{ of } \frac{4\frac{3}{4}}{2\frac{1}{4}} + \frac{1}{2\frac{1}{4}} \text{ of } \frac{4\frac{1}{2}}{3\frac{1}{2}} - \frac{1\frac{8}{9}}{14}.$

4. State the rule for the division of decimal fractions. Divide 174.45 by .0375; 17.445 by 37.5, and 6.32 by .17, correct to four places of decimals.

5. The driving-wheel of an engine, which is 16 ft. 6 in. in circumference, makes 4 revolutions in 3 seconds; at how many miles an hour is the train travelling?

6. Convert into their equivalent vulgar fractions .2083, .583 and .3468, and convert without division into circulating decimals $\frac{6322}{9990}$ and $\frac{826131}{999900}$.

7. Extract the square root of 19 and of 1.9 correct to four places of decimals, and find the value of $\frac{2}{\sqrt{19-4}}$ to the same degree of accuracy.

8. In any year which is not a leap year, show that the same days of the month in January and October will fall on the same days of the week.

9. A decimetre is equal to 3.937 inches; and a cubic decimetre of water weighs one kilogramme. If a cubic inch of water weigh 252.45 grains, express a kilogramme in pounds avoirdupois, correct to two decimal places.

10. What is meant by a bill, and by discounting a bill? Illustrate your answer by an example. Find the discount on a bill for £498 18s. due in 10½ months, discounted at 4½ per cent.

11. What sum of money will amount to £706 8s. 48d. in two years, reckoning compound interest, for one year at 4 per cent. and for the other at 4½ per cent.?

12. A railway proprietor receives one year a dividend of 7 per cent. on his stock, and pays an income-tax of 6d. in the pound. The next year he receives a dividend of 7½ per cent. and pays an income-tax of

4d. in the pound, and finds that he is £73 richer. How much railway stock does he hold ?

EXERCISE CCCXXXVI.

1. What is expressed respectively by the several digits in the number 675·239 ? Express in words the number 1234567890.

2. Find the rent of a farm containing 159 acres. 3 rds. 25 pls. at £2 17s. 4d. per acre.

3. Simplify the fractions

$$\left(\frac{3}{4} + \frac{1}{2}\right) \text{ of } \frac{5}{8} + \frac{7}{8} \quad \text{and} \quad \frac{6\frac{1}{2}}{12\frac{1}{2}} + \frac{6\frac{1}{2}}{9\frac{1}{2}} - \frac{4\frac{1}{2}}{7}.$$

4. State the rule for the division of decimal fractions. Divide 673·5 by 1·25, ·06735 by ·125, and 17·25 by 7·6, correct to four places of decimals.

5. A railway train is travelling at the rate of 45 miles an hour ; how many revolutions does the driving wheel of the engine, which is 22 feet in circumference, make in a second ?

6. Convert into their equivalent vulgar fractions ·416̄, ·083̄, and ·4369̄, and convert without division into circulating decimals $\frac{5271}{9990}$ and $\frac{123645}{999900}$.

7. Extract the square root of 17, and of 1·7, correct to four places of decimals, and find the value of $\frac{4}{\sqrt{17} - 3}$, to the same degree of accuracy.

8. In any year show that the same days of the month in March and November will fall on the same days of the week.

9. A cubic inch of water at a certain temperature contains 252·458 grains. Determine which is the more accurate of the following rough statements of a fact : a cubic foot of water weighs about 1000 ounces avoirdupois ; a cubic yard weighs about three-quarters of a ton.

10. What is meant by a bill, and its present worth ? Illustrate your answer by an example. Find the present worth of a bill for £279 2s. 6d. due in 4½ months, discounted at 4 per cent. per annum.

11. What sum of money will amount to £699 13s. 2·4d. in two years, reckoning compound interest for one year at $3\frac{1}{2}$ per cent. and for the other at 4 per cent. per annum?

12. A railway proprietor receives one year a dividend of 6 per cent. on his stock, and pays an income-tax of 4d. in the pound. The next year he receives a dividend of $6\frac{1}{2}$ per cent., and pays an income-tax of 3d. in the pound, and finds that he is £249 richer. How much railway stock does he hold?

EXERCISE CCCXXXVII.

1. Find the product of the sum and difference of sixty-four thousand five hundred and twenty-two, and six hundred and eighty-five thousand four hundred and seventy-nine.

2. Resolve 11781 into its prime factors. Find the G. C. M. and the L. C. M. of 5083, 14053, 10387.

3. Find the rent of 125 a. 1 rd. 36 pls. at £2 15s. 6d. per acre.

4. Find the square root of the number of seconds in thirty-one thousand nine hundred and seventy-four days; and the square root of $\frac{2}{3}$ to three places of decimals.

5. Multiply 34·56 by .006543, and divide the product by .0727.

6. Simplify

$$\frac{6\frac{5}{8} - 5\frac{5}{8} + 9\frac{7}{12} - 8\frac{1}{2} - 1\frac{9}{10}}{1 + \frac{1}{2} + \frac{1}{20} + \frac{1}{120}}.$$

and $\frac{5}{8}$ of .0375 of £1 + .3125 of 10s. + $\frac{1}{4}$ of .539 of 1s. 10 $\frac{1}{2}$ d.

7. Divide £500 between two persons so that they may have equal sums remaining when one has bought 5 tons 8 cwts. of sugar at $5\frac{1}{2}$ d. a pound, and the other 2 tons 9 cwts. at $6\frac{1}{4}$ a pound.

8. A man saves £50 every year, and puts it out at 5 per cent. compound interest; what will be the amount at the end of the fourth year?

9. What is the present value of £1436 10s. due at the end of $2\frac{1}{2}$ years, at 4 per cent. simple interest?

10. What sum is that which, if invested in the $3\frac{1}{2}$ per Cents at $91\frac{1}{2}$, would produce £1 more per annum than if invested in the 4 per Cents at $122\frac{1}{2}$?

11. First, second, and third class fares being $2\frac{1}{4}$ d., 2d., and 1d. a mile respectively, a person who travels third class pays 5s. 6d. less than one who travels equal portions of the same distance by each of the three classes. Find the distance.

12. What is the least possible number of days in 2000 consecutive calendar months?

EXERCISE CCCXXXVIII.

1. Find the product of the sum and difference of seventy-five thousand nine hundred and forty-three, and eight hundred and seventy-six thousand and fifty-eight.

2. Resolve 19019 into its prime factors. Find the G. C. M. and the L. C. M. of 6916, 10686, 14729.

3. Find the rent of 521 a. 2 rds. 32 pls. at £3 13s. 8d. per acre.

4. Find the square root of the number of seconds in a hundred and thirty-three thousand two hundred and twenty-five hours; and the square root of $\frac{2}{3}$ to three places of decimals.

5. Multiply 65.45 by .003654, and divide the product by .01421.

6. Simplify

$$\frac{2\frac{1}{6} - 3\frac{7}{8} + 8\frac{5}{24} - 5\frac{3}{8} + \frac{4}{3}}{1 - \frac{1}{3} + \frac{1}{30} - \frac{1}{120}}$$

and $\frac{5}{8}$ of .075 of £1 + $\frac{4}{7}$ of .539 of £1 0s. 7 $\frac{1}{2}$ d. + $\frac{1}{.23}$ of 10 $\frac{1}{2}$ d.

7. Divide £1000 between two persons so that they may have equal sums remaining when one has bought 8 tons 5 cwts. of sugar at 5 $\frac{1}{2}$ d a pound, and the other 3 tons 19 cwts. at 6 $\frac{1}{2}$ d. a pound.

8. A man saves £50 every year, and puts it out at 4 per cent. compound interest; what will be the amount at the end of the fourth year?

9. What is the present value of £436 10s. due at the end of 2 $\frac{1}{2}$ years, at 4 per cent. simple interest?

10. What sum is that which, if invested in the 3 $\frac{1}{2}$ per Cents at 91 $\frac{7}{8}$, would produce £1 less per annum than if invested in the 5 per Cents, at 122 $\frac{1}{2}$?

11. First, second, and third class fares being 3d., 2 $\frac{1}{4}$ d., and 1d. a

mile respectively, a person who travels third class pays 6s. 6d. less than one who travels equal portions of the same distance by each of the three classes. Find the distance.

12. What is the greatest possible number of days in 2000 consecutive calendar months?

EXERCISE CCCXXXIX.

1. Add $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \frac{5}{6} + \frac{1}{12}$.
2. G. C. M. of 2526 and 2947.
3. If 5 of £1 buy 4 of a gallon, how much may be bought for 6s. 3d.?
4. Find the simple interest on £375, at 4 per cent. for 4 years.
5. Divide £1300 into three parts in the ratio of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.
6. Find the square root of 449.44 and .0001.
7. Find the cost of carpeting a room 21 ft. by 30 ft. with carpet $\frac{1}{2}$ -yard wide at 4s. 6d. per yard.
8. If 12 men do a piece of work in 15 days of 10 hours, how many days of 9 hours will 10 men take to do it?
9. Find the income produced by investing £4500 in the 3 per Cents at 90, and that produced by investing £2850 in the $3\frac{1}{2}$ per Cents at 95.
10. A steam-engine and a horse start together; the engine does the first mile in 5 minutes, the horse in 4; after this mile the pace of the engine is 30 miles an hour, that of the horse 20. Which will win in a 3 mile race, and by how much?

EXERCISE CCCXL.

1. Add $2\frac{2}{3}$, $\frac{1}{2}$, $3\frac{1}{3}$, $\frac{5}{12}$, $\frac{3}{4}$, and subtract $\frac{1}{7}$ from $\frac{1}{2}$, $\frac{1}{4}$ from $\frac{1}{3}$.
2. Find the sum and difference of 1.23 and 12.3; and of 1.075 and 1.0075.
3. Multiply ($\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$) by ($\frac{1}{3}$ of $1\frac{1}{2}$ of $1\frac{1}{3}$ of $1\frac{2}{3}$) and divide the result by ($\frac{1}{3}$ of $\frac{1}{4}$ of $2\frac{2}{3}$).
4. Multiply .12 by 12, by 1.2 and by .012 separately; and divide 2.25 by 15, by .15, by 1.5, and by .015 separately.

5. A man had an income of £100 a year from the 3 per Cents ; he sold out at 75, and invested in the 5 per Cents at 80 ; how much income did he gain or lose ?

6. Reduce 2s., 4s., 6s. 8d., 13s. 4d., to (1) vulgar fractions, (2) decimal fractions.

7. In a room 22 ft. by 18 ft. there is a carpet 16 ft. square ; find the cost of covering the rest of the room, in felt, 2 ft. wide, at 5s. per yard.

8. If 4 men plough 15 acres in 12 hours, how long would it take 7 men to plough 14 acres ?

9. What sum of money will amount to £100 in 3 years, at 4 per cent. simple interest ?

10. If an ounce of gold is worth £3 17s. 6d., how much gold should there be in a sovereign made without alloy ?

EXERCISE CCCXLI.

1. Find the value of $(1 \times \frac{1}{2} \times \frac{1}{3}) \times (1 + \frac{1}{2} + \frac{1}{3}) \times (1 - \frac{1}{2} - \frac{1}{3})$.

2. Find the value of $\frac{822}{1000} - (.8 + .02 + .002)$.

3. What is the cost of carpeting a room 16 ft. wide by 21 ft. long, with carpet $\frac{3}{4}$ -yard wide, at 5s. 3d. per yard ?

4. A man has £1000 in $3\frac{1}{2}$ per Cents ; he sells at 95, and reinvests in the 3 per Cents at 76 ; what is the difference in the income ?

5. If Moira coal costs 31s. per ton, and Wallsend 46s. per ton, how much do I gain or lose by buying 24 tons of Moira, supposing 3 tons of Wallsend last as long as 4 tons of Moira ?

6. Find the square root of 1974·8136.

7. If 5000 bricks, 4 inches thick, are required for a wall 125 feet long, how many bricks 5 inches thick will be required for a wall 80 feet long ?

8. If 9 men do a piece of work in 8 days, how many will do $\frac{1}{3}$ of the work in $2\frac{2}{3}$ days ?

9. Find the value of .723 of £8 6s. 8d., and reduce .64 of £1 to the decimal of 1s. 3d.

10. A bankrupt paid 5s. 11d. in the £, his assets being £71; what were his debts?

11. A man invests £840 in the 3 per Cents at 90, sells out at 81, and reinvests in the 5 per Cents at 108; what is then his income?

12. A hospital ward is 50 ft. long, 20 ft. wide, and 15 ft. high; how many patients would it accommodate at 600 feet of air each?

13. Find the compound interest on £150 for 3 years, at 4 per cent.

14. How many yards of paper, 2 ft. wide, will be required to cover a box 7 ft. long, 4 ft. wide, and 3 ft. deep?

EXERCISE CCCXLII.

1. A, B, and C purchased a ship for £3300; B paid twice as much as A, C paid 4 times as much as B; how much did each pay?

2. A garrison of 1000 men has provisions for 30 days; at the end of 10 days a reinforcement arrives, the provisions then last 5 days only; what was the number of the reinforcement?

3. Reduce 4s. 6½d. to the fraction of £1, and ⅓th of a shilling to the fraction of 2d.

4. Find the value of (1) ⅓ths of a dozen, (2) ⅓rds of £17 17s. 6d. + ⅓ths of 1½ of £1 + ⅓ths of a crown.

5. Simplify $\frac{(2 + \frac{1}{2}) \div (3 + \frac{1}{2})}{(\frac{1}{2} - \frac{1}{3}) \times (4 - 3\frac{1}{2})}$

6. Divide 2·975984 by 32·56, and 48 by ·04.

7. Reduce 4½d. to the decimal of a crown. State the value of ·625 of a shilling.

8. Express ·466 as a vulgar fraction, and multiply 3·59 by 4·7.

9. Find the square root of 3272869681 and 29·41275.

10. G. C. M. of 43365 and 44688.

11. A sum of money is borrowed at 5 per cent. per annum simple interest; in 7 years it amounts to £810; what is the sum borrowed?

12. Show, by practice, the price of 75 cwts. 3 qrs. 21 lbs. of hops, at £5 15s. 6d. per cwt.

13. What is the whole surface of the walls of a room 22 ft. 5 in.

long, 18 ft. 4 in. broad, and 10 ft. 9 in. high ; and the expense of painting, at 8d. per square foot ?

14. If 100 men, in 6 days of 10 hours each, can dig a trench 200 yards long, 3 yards wide, and 2 yards deep, in how many days of 8 hours long can 180 men dig a trench 360 yards long, 4 yards wide, and 3 yards deep ?

15. What is the present worth of £360 10s., due in 11 months, at 6 per cent ? Prove answer.

16. A train 88 yards long overtook a person walking along the line at the rate of 4 miles an hour, and passed him completely in 10 seconds ; it afterwards overtook another person, and passed him in 9 seconds ; at what rate per hour was the second person walking ?

EXERCISE CCCXLIII.

1. A man has to place 10 stones in a row, 10 yards apart from each other, returning for each stone separately to the place of starting ; how far will he have to walk, supposing that he deposits the first stone at the place of starting ?

2. If I devote 6 hours of the 24 to sleep, $\frac{3}{8}$ ths of the remainder to exercise, and $\frac{7}{8}$ ths of what then remains to study, how much time will be left ?

3. Multiply together .03, .02, and .0001, and divide 42.5 by .017.

4. Reduce 5s. 10d. to the fraction of £4 6s. 8d., and find the value of .625 of 3 lbs. avoirdupois.

5. If a man buy 560 tons of coal at 14s. 8d. per ton, and sell them at 11d. per cwt. (1) how much will he gain ? (2) what per cent. ?

6. Find the square root of .6775609 and 1.00060009.

7. If 5 men build a wall 5 feet high and 100 yards long in 3 days, how long will it take 7 men to build a wall 200 yards long and $3\frac{1}{2}$ ft. high ?

8. The gross yearly rental of an estate is £2100, and the deductions for rates and repairs amount to £25 per annum ; the owner sells the estate for 21 times the gross yearly rental, and invests the proceeds in the $3\frac{1}{2}$ per Cents at 98 ; what does he gain or lose ?

9. A room is 10 ft. high, 5 yds. 1 ft. long, and 3 yds. broad ; it contains a door 8 ft. by 4 ft., two windows, each 5 ft. by 4 ft., and fireplace 6 ft. by 4 ft. 6 in. ; how much paper is required to cover the walls ?

10. The total number of votes polled at an election was 3854, and the successful candidate polled 206 more than the other ; what were the numbers polled ?

EXERCISE CCCXLIV.

1. Add together sixteen million and sixty, forty million four hundred thousand and four, two hundred and nine thousand and two, and ninety-one thousand five hundred and one, and divide the result by ninety-nine.

2. Simplify $\frac{4\frac{2}{3} - \frac{5}{8} \text{ of } 4\frac{2}{3} + 6 \div 4\frac{2}{3}}{18\frac{8}{9} \div 8 - 8\frac{2}{3} \text{ of } 1\frac{1}{4}}$.

3. Multiply $\frac{5\cdot76}{\cdot018}$ by $\frac{\cdot00196}{\cdot64}$, and subtract $\frac{\cdot159}{\cdot0212}$ from $\frac{1851\cdot85}{25\cdot9}$.

4. Add $\frac{1}{3}$ ths of £9 6s. 10½d. to 35¼ of £32 1s. 8d., and express the result as the decimal of £30.

5. Find the cost of paving a floor 11 yds. 2 ft. long by 9 yds. 2½ ft. wide with tiles 7 inches square, which cost £3 4s. 7d. per 100.

6. Find the value of $\sqrt{144} - \cdot079\dot{3}$ correct to four places of decimals.

7. A sum of £52 18s. is made up of half-sovereigns, half-crowns, and sixpenny pieces, the numbers of the several coins being in the proportion of 3, 5, 7 ; how many are there of each ?

8. What sum will amount to £353 12s. in 2 years and 4 months, at 4½ per cent. per annum simple interest ?

9. The present value of a bill of £169 19s. 4½d. due 1 year and 3 months hence is £163 6s. 8d. ; at what rate per cent. is the simple interest calculated ?

10. A grocer has a stock of tea which he must sell at 3s. 4½d. per lb. in order to gain 35 per cent. ; how much will he gain per cent. if he mix it in the proportion of 5 to 2 with inferior tea which cost

him 2s. 1d. per lb., and sells the mixture at the rate of 14 lbs. for £2 5s. ?

11. A person holds a certain amount of stock in the 3 per Cents; he sells out when they are at 96, and invests the proceeds in railway shares which are at £112 per £100 share, and pay $5\frac{1}{2}$ per cent. What amount of stock in the 3 per Cents did he originally hold if his income from the railway shares be £121 ?

12. A and B ride a race of 31 miles on bicycles, the circumference of the driving-wheels being 168 and 162 inches respectively. B's driving-wheel makes 3520 revolutions in an hour, while A's makes 3410. Which will win, and by how much ?

EXERCISE CCCXLV.

1. Subtract five million three hundred and three farthings from ten thousand and twenty-one guineas.

2. Simplify $\frac{5\frac{3}{4} - \frac{2}{3} \text{ of } 15\frac{3}{4} + 2\frac{2}{3} \div 1\frac{1}{2}}{\frac{2}{3} \text{ of } 7\frac{3}{4} - 5\frac{3}{4} \div 3\frac{1}{5}}$.

3. Add together $\frac{3.9}{.104}$ and $\frac{.057}{.22.8}$ and multiply $\frac{115}{.0092}$ by $\frac{1451.45}{1160}$.

4. Add .3795 of 18s. to .4360 of £9 5s., and express the result as a decimal of £5.

5. In walking a distance of 5 mls. 6 fur. $199\frac{1}{3}$ yds. a man takes 12114 steps; find the length of his step.

6. The area of a square field is 3 rds. 19 pls. $20\frac{1}{4}$ sq. yds.; find the dimensions of a rectangular field of the same area whose length exceeds that of the square field by 104 yards.

7. If £4 sterling be worth 117 lire in Italian currency, and 23.4 lire be worth 21 francs, express £26 3s. 4d. in francs and centimes (1 franc = 20 centimes).

8. On what sum does the simple interest for $4\frac{1}{2}$ years at 6 per cent. amount to £276 6s. $6\frac{3}{4}$ d. ?

9. If the discount on a bill of £157 13s. 4d. be £40 6s. 8d., simple interest being calculated at $5\frac{1}{2}$ per cent. per annum, how long has the bill to run ?

10. A tobacconist makes a profit of £6 11s. 3d. by the sale of

4 cwts. 2 lbs. of tobacco, at 1s. 2d. per lb. ; what is his gain per cent. ?

11. A person holds New Zealand 5 per cent. bonds to the amount of £2600. He sells out when they are at £104 per £100 bond, and invests the proceeds in shares in a mine paying 6 per cent. What must be the price of the latter if his income from them exceed his former income by £8 13s. 4d. ?

12. A, B, and C can together do a piece of work in 5 days, but A strikes after working 2 days, and B and C finish it in 5 days more. C can do the whole work by himself in 15 days. In what time can A and B respectively do it ?

EXERCISE CCCXLVI.

1. Add together two hundred and three guineas, two thousand and three half-crowns, and two million three hundred farthings.

2. Simplify $\frac{\frac{2}{3} \text{ of } 5\frac{1}{2} - 3\frac{2}{3} \div 1\frac{2}{3} + 10\frac{7}{8}}{3\frac{2}{3} - \frac{2}{3} \text{ of } 6\frac{2}{3} - 1\frac{2}{3}}$.

3. Add together $\frac{5\cdot7}{1\cdot52}$ and $\frac{0\cdot111}{\cdot74}$, and multiply $\frac{\cdot85}{\cdot0068}$ by $\frac{1151\cdot15}{1610}$.

4. Subtract $\cdot4625$ of 16s. from $\cdot113\bar{6}$ of £8 5s., and express the result as a decimal of £3.

5. If the length of a man's step be $30\frac{1}{2}$ inches, how many steps does he take in walking 5 mls. 5 fur. $144\frac{2}{3}$ yards ?

6. Find the length of the side of a square field containing 2 acres 2 rds. 37 pls. $5\frac{1}{4}$ sq. yds.

7. If £5 sterling be worth 127 francs, and 20 francs be worth 22·5 lire in Italian currency, express £24 16s. 8d. in lire and centesimi (1 lire = 100 centesimi).

8. In what time will £279 0s. 9d. amount to £348 15s. $11\frac{1}{4}$ d. at $3\frac{1}{2}$ per cent. per annum, simple interest ?

9. If the discount on a bill of £226 16s. $5\frac{1}{2}$ d. due 15 months hence be £10 3s. $1\frac{1}{2}$ d., what is the rate per cent. of simple interest ?

10. By selling tobacco at 1s. 3d. per lb. a tobacconist gains 35 per cent. ; what does his profit amount to on the sale of 4 cwts. 11 lbs. ?

11. A person invests £3636 in railway shares paying $5\frac{1}{2}$ per cent.,

the price of a £100 share being £120. He sells out when the shares are at 136, and invests the proceeds in the Moscow Jaroslavl railway 5 per cent. debentures, the price being £101 per debenture of £100. Find the difference of the incomes derived from the two investments.

12. A can do one-half as much again as B can do in the same time, and B can do one-third as much again as C. Working together they can do a certain piece of work in 5 days, but if after working two days A strikes, how long will B and C take to finish it?

EXERCISE CCCXLVII.

1. Find the difference of seventy-seven million and seven, and four hundred and ninety-nine thousand four hundred and forty, and divide the result by ninety-nine.

2. Simplify $\frac{2\frac{2}{3} - \frac{1}{3} \text{ of } 4\frac{2}{11} + 3\frac{1}{2} \div 7\frac{1}{2}}{3\frac{1}{4} \text{ of } 10\frac{1}{2} - 3\frac{7}{11} \div 4\frac{1}{2}}$.

3. Subtract $\frac{0.169}{26}$ from $\frac{1.05}{0.14}$, and multiply $\frac{1551.55}{65.1}$ by $\frac{21}{20.02}$.

4. Subtract 0.254 of £134 1s. 3d. from $\frac{1}{3}$ ths of £5 3s. $1\frac{1}{2}$ d., and express the result as a decimal of £3.

5. If the cost of paving a floor $12\frac{1}{2}$ yds. long by 6 yds. $4\frac{1}{2}$ in. wide, with tiles each 7 inches square, be £70 17s. 6d., find the price of the tiles per 100.

6. Find the value of $\sqrt{121} - 0.47$ correct to three places of decimals.

7. A sum of £38 4s. is made up of half-sovereigns, half-crowns, and threepenny-pieces. There are twice as many half-crowns as half-sovereigns, and the number of half-sovereigns bears to the number of threepenny-pieces the ratio of 3 to 11. How many are there of each coin?

8. At what rate will £560 amount to £649 12s. in 3 years at simple interest?

9. On what amount due $4\frac{1}{2}$ years hence does the discount amount to £27 6s. 6d., simple interest being calculated at the rate of $5\frac{1}{2}$ per cent. per annum?

10. A grocer has a stock of tea which he must sell at 3s. 4d. per lb. in order to gain $33\frac{1}{3}$ per cent., but if he mix it with inferior tea in the proportion of 4 to 1 he can gain the same percentage of profit by selling the mixture at the rate of 15 lbs. for £2 7s. What did the inferior tea cost him ?

11. A person derives an income of £126 13s. 4d. from money invested in the 3 per Cent. Consols. He sells out when they are at 93, and buys Russian $3\frac{1}{2}$ per Cents at 95. By how much is his income increased by the transfer ?

12. A and B ride a race of 16 miles on bicycles. The driving-wheel of A's bicycle makes 550 revolutions in 9 minutes, while that of B's bicycle makes 600. A accomplishes the distance in 1 hr. 42 min. 24 secs., and wins by 3 min. 12 secs. Find the circumferences of the driving-wheels.

ANSWERS.

FIRST PART.

EXERCISE I.

(1) One hundred and eighty-nine, six hundred and forty, two hundred and nine.

(2) 421, 504, 260.

(3) 29011.

(4) 2160758.

(5) 1143460.

(6) 1423011.

EXERCISE II.

(1) £11 16s. 3d.

(2) £11 8s.

(3) 16s. 7d.

(4) Watch £24, chain and brooch, each £3.

(5) £3 16s. 8d.

(6) Difference, 432000.

EXERCISE III.

(1) Two thousand four hundred and sixty-eight, three thousand four hundred and seventy, eight thousand five hundred and six.

(2) 6804, 2060, 4009.

(3) 2348415.

(4) 5113600.

(5) 3917.

(6) 2398.

EXERCISE IV.

(1) $37\frac{1}{2}$.

(2) 38gs. 4s. 6d., £1885 17s. 6d.

(3) £69 4s.

(4) $469\frac{1}{2}$ miles.

(5) £138.

(6) 98 yrs. 27 wks. 4 days 18 hrs. 36 min.

BARTER'S

EXERCISE V.

(1) Five thousand six hundred, eight thousand four hundred and seven, five thousand and six.

(2) 7204, 3025, 60001.

(3) 4568593.

(4) 365 days.

(5) 6779495691.

(6) 61333.

EXERCISE VI.

(1) $3\frac{1}{2}$ mls.

(2) 45 eggs.

(3) 3 hrs.

(4) 51 lbs. 2 oz. 10 dwts. 16 grs.

(5) 45 days.

(6) £264.

EXERCISE VII.

(1) Twenty-four thousand eight hundred and sixty-four, forty thousand two hundred and seventy-five, eight thousand and thirty-six.

(2) 32325, 50104, 70010.

(3) 12413.

(4) 427.

(5) 336.

(6) 1789.

EXERCISE VIII.

(1) £84 10s.

(2) £9 6s. 8d.

(3) 24 shops.

(4) 140.

(5) £2 4s. 8d.

(6) 9s.

EXERCISE IX.

(1) 1824386543.

(2) 324213898.

(3) 593684254 ; 4230399881.

(4) 452135002071.

(5) 5024659561.

(6) 1486958060.

EXERCISE X.

(1) £27 1s. 8d.

(2) 2505600 sec.

(3) £468 9s.

(4) 496.

(5) 1075 fourpenny pieces.

(6) 20 mls.

EXERCISE XI.

(1) 43606640 ; 68604840.

(2) 851576880 ; 80737410.

(3) 199617.

(4) 3694492.

(5) 474472.

(6) $2402\frac{2}{3}\frac{1}{2}$.

EXERCISE XII.

- | | | |
|-------------|-----------------|---------------------------------|
| (1) 4s. 2d. | (2) £49 and £7. | (3) 15 cwt. 2 qrs. |
| (4) 80. | (5) £31937 10s. | (6) £121 8s. 6 $\frac{1}{2}$ d. |

EXERCISE XIII.

- | | |
|---------------------------|-------------------------|
| (1) 1291650783. | (2) 80439481. |
| (3) 5040 $\frac{1}{11}$. | (4) 35868157. |
| (5) 3435 $\frac{1}{3}$. | (6) 962 $\frac{7}{8}$. |

EXERCISE XIV.

- | | | |
|------------------------|-------------------------------|---------------------------------|
| (1) 2 $\frac{1}{4}$ d. | (2) 13. | (3) £2 17s. 10 $\frac{1}{2}$ d. |
| (4) 575. | (5) 54 $\frac{6}{11}$ loaves. | (6) 2 ft. 6 in. |

EXERCISE XV.

- | | | |
|------------------------|---------------|-------------|
| (1) 9 $\frac{3}{4}$ d. | (2) 10 rooms. | (3) 1s. 6d. |
| (4) 594. | (5) 160. | (6) £75. |

EXERCISE XVI.

- | | |
|--------------------------|-------------------|
| (1) 139920 ft. | (2) 91430000 mls. |
| (3) 15s. 6d. | (4) £1 10s. |
| (5) 18 wks. 3 dys. 1 hr. | (6) £10 14s. 6d. |

EXERCISE XVII.

- | | |
|------------------------------|------------|
| (1) 10470, 8376, 9865881, 9. | (2) 127. |
| (3) 75497472. | (4) 17030. |
| (5) 153. | (6) 2399. |

EXERCISE XVIII.

- | | | |
|--|-----------------|---------------------------|
| (1) £147 17s. 6d. | (2) £97 4s. 5d. | (3) 25 $\frac{1}{2}$ yds. |
| (4) In £87 2s. ex. £70 4s., savings £16 18s. | (5) £19 7s. | |
| (6) Father's, £4 10s.; son's, £2 5s. | | |

EXERCISE XIX.

- | | | |
|----------------|-------------|---------------|
| (1) £14425. | (2) £13696. | (3) 66 pages. |
| (4) 714 pence. | (5) 13 lbs. | (6) 17s. 11s. |

EXERCISE XX.

- (1) Purse contained £2 5s. before payment, £1 1s. 3d. after.
 (2) Gains £36 5s. (3) £141 16s.
 (4) £9 7s. 11d. (5) £8 2s.
 (6) 100d.

EXERCISE XXI.

- (1) £3 15s. per wk. (2) 14s. (3) 8 wks., 3s. per day.
 (4) 532240 in. (5) 62850 threepenny pieces.
 (6) 5788 hrs.

EXERCISE XXII.

- (1) £3000 ; others £2250 each. (2) 11 a. 3 rds. $7\frac{7}{8}$ pls.
 (3) £69 15s. 10d. (4) £40 1s. 8d.
 (5) $\frac{1}{4}$ d. per button. (6) 7s. 9d. each.

EXERCISE XXIII.

- (1) 48 mls. (2) £48. (3) 1s. 3d. at first.
 (4) 1721 tons 14 cwts. 1 qr. 4 lbs. (5) 15 carriages ; 3 for last.
 (6) 27 pls. 2 yds. 1 ft. $2\frac{1}{8}$ in.

EXERCISE XXIV.

- (1) £82 10s. (2) £1 6s. 3d. (3) 80 books.
 (4) £44 a year. (5) 32 men. (6) 154 to each.

EXERCISE XXV.

- (1) £1080. (2) £7 12s. 1d. (3) £87 15s.
 (4) $772\frac{1}{2}$ half-crowns. (5) 2 wks. 3 days 3 hrs. 29 min.
 (6) £2 8s. $0\frac{1}{4}$ d. + 345.

EXERCISE XXVI.

- (1) £330. (2) £1 3s., 10s. (3) 95 guineas, 5s.
 (4) £7 5s. 10d. (5) £377 9s. 8d. (6) 2s. $7\frac{1}{2}$ d.

EXERCISE XXVII.

- (1) $224\frac{1}{2}$ mls. (2) £1 8s. $1\frac{1}{2}$ d. (3) 5s. 6d.
 (4) 3 days. (5) £4205 5s. (6) 4 fur. 13 pls. 2 yds. $8\frac{1}{8}$ in.

EXERCISE XXVIII.

- | | |
|-------------------------------------|----------------------|
| (1) 15s. 9d. 7s. $10\frac{1}{2}$ d. | (2) 39. |
| (3) 15353. | (4) 76032000. |
| (5) 184081. | (6) $1\frac{2}{3}$. |

EXERCISE XXIX.

- | | | |
|-------------------|-----------------|----------------------------------|
| (1) £2 14s. | (2) £2 14s. 2d. | (3) 217 oranges. |
| (4) $544 + 107$. | (5) 7 each. | (6) $2031529\frac{1}{2}$ sq. ft. |

EXERCISE XXX.

- | | |
|--|----------------------------------|
| (1) A £3 B £4 10s. C £1 10s. | (2) 3 cwts. 3 qrs. 26 lbs. 4 oz. |
| (3) 5 men. | (4) $28\frac{1}{2}$ days. |
| (5) 2 tons 4 cwts. 3 qrs., 1 ton 5 cwts. 1 qr. | (6) 1d. each. |

EXERCISE XXXI.

- | | | |
|--|--------------------|------------|
| (1) $4\frac{1}{2}$ hrs. | (2) 559. | (3) 15084. |
| (4) $2501\frac{1}{10}$. | (5) 50310 sq. yds. | |
| (6) 62 days. 1488 hrs. 89280 min. 5356800 sec. | | |

EXERCISE XXXII.

- | | | |
|-------------|------------------------------|----------------|
| (1) 4568. | (2) 50662. | (3) £1 11s. |
| (4) 138720. | (5) £3 5s. $7\frac{1}{2}$ d. | (6) 52 spokes. |

EXERCISE XXXIII.

- | | | |
|-------------------------|--------------------|----------------------------|
| (1) 9s. 9d. | (2) 14s. 6d. | (3) $7\frac{3}{4}$ pounds. |
| (4) $8514\frac{2}{3}$. | (5) 348 oz. 3 drs. | (6) 673. |

EXERCISE XXXIV.

- | | | |
|--------------------------|----------------|------------------|
| (1) 57610. | (2) £151 6s. | (3) 351 letters. |
| (4) 64 more in the O. T. | (5) 429. | |
| | (6) 16 loaves. | |

EXERCISE XXXV.

- | | | |
|---------------------------------|---|-------------------|
| (1) £1 15s. $1\frac{1}{2}$ d. | (2) £3 11s. 6d. | (3) £228 12s. 6d. |
| (4) £10 16s. $10\frac{1}{2}$ d. | (5) 16 a. 2 rds. 26 pls. 20 yds. 1 ft. 72 in. | |
| | (6) 22 m. 4 f. 13 p. | |

EXERCISE XXXVI.

- | | | |
|--------------|--------------|---------------|
| (1) 24263. | (2) 2s. 11d. | (3) 113880. |
| (4) £68 15s. | (5) £2 5s. | (6) 14766840. |

EXERCISE XXXVII.

- | | | | |
|----------------------------------|-------------|---------|----------|
| (1) 2s. 3d. | (2) £1 15s. | (3) 50. | (4) 41. |
| (5) 17 bags 4 buns for the last. | | | (6) 135. |

EXERCISE XXXVIII.

- | | | |
|-----------------|------------|--------------------------------|
| (1) 11599. | (2) 44928. | (3) 16. |
| (4) £1 2s. 11d. | (5) £292. | (6) £5 13s. 5 $\frac{2}{3}$ d. |

EXERCISE XXXIX.

- | | | |
|------------------------------------|--|-------------|
| (1) £1 3s. 7d. | (2) 4s. | (3) 28 wks. |
| (4) £340477 7s. 6 $\frac{3}{4}$ d. | (5) 5 drs. 2 scs. 8 $\frac{2}{3}$ grs. | |
| | (6) 8348. | |

EXERCISE XL.

- | | |
|-------------------|------------------------------------|
| (1) 15192. | (2) £17 6s. £8 13s. 0d. £4 6s. 6d. |
| (3) 40 mls. | (4) 49. |
| (5) A pays £5 5s. | (6) 1s. 9d. |

EXERCISE XLI.

- | | | |
|-------------|---|--------------|
| (1) 6s. 3d. | (2) 938 $\frac{2}{3}$. | (3) £40, £5. |
| (4) 1475. | (5) 74 yds. 2 ft. 1 in. | |
| | (6) 14 cwts. 3 qrs. 13 lbs. 9 oz. 1 $\frac{2}{3}$ dr. | |

EXERCISE XLII.

- | | | |
|------------------|-----------------------------|--------------|
| (1) 2880. | (2) 16s. 9 $\frac{3}{4}$ d. | (3) £44 16s. |
| (4) £81 14s. 6d. | (5) £20 6s. 1d. | (6) 225. |

EXERCISE XLIII.

- | | | |
|---|-------------------------------------|-------------|
| (1) 24. | (2) 13s. 10 $\frac{1}{4}$ d. | (3) 180 oz. |
| (4) 10 $\frac{1}{2}$. | (5) 12 tons 14 cwts. 2 qrs. 15 lbs. | |
| (6) 112 a. 2 rds. 37 pls. 12 yds. 2 ft. 108 in. | | |

EXERCISE XLIV.

- (1) 4371428 $\frac{1}{2}$ ft. (2) 68 lbs.
 (3) First £9 2s. 3d. ; each of others £2 5s. 9d.
 (4) 5 hrs. ; 20 miles from A, 15 miles from B.
 (5) 19 books. (6) 651 $\frac{7}{11}$ packets.

EXERCISE XLV.

- (1) 2s. 1d. (2) Man 12s., woman 6s., child 3s.
 (3) £3 4s. 3d. (4) 415165.
 (5) 210. (6) 5 per. 29 yds. 4 ft. 100 in.

EXERCISE XLVI.

- (1) £2 17s. 3d. (2) £200. (3) £105 6s.
 (4) 877 $\frac{1}{2}$. (5) 18 yds. (6) 5 days 5 hrs.

EXERCISE XLVII.

- (1) 13s. 9d. (2) 160 pints. (3) £1278 6s. 8d.
 (4) 40 mls. 4 fur. 8 pls. 5 yds. 1 in. (5) £2 10s. 3 $\frac{26}{11}$ $\frac{7}{5}$ d.
 (6) 838 yrs. 10 mths. 3 wks. 3 days 12 hrs.

EXERCISE XLVIII.

- (1) 27 $\frac{1}{8}$ poles. (2) £78 11s. gain. (3) 74 yds.
 (4) 7 $\frac{1}{2}$ d. (5) 164. (6) £5 6s. 9 $\frac{1}{2}$ d.

EXERCISE XLIX.

- (1) 10d. (2) 1s. 9d. (3) £3 12s. 6d.
 (4) 202878. (5) £2 2s. (6) 8466.

EXERCISE L.

- (1) 3891, 109. (2) 81. (3) 45.
 (4) First 5s., others 2s. 6d. each. (5) £1 10s.
 (6) 40.

EXERCISE LI.

- (1) 4s., 2s. (2) £1 17s. 6d. (3) 160 shoes, 40 pegs.
 (4) 3 a. 3 rds. 38 pls. 26 yds. 6 ft. 4 in.
 (5) 1254 m. 7 fur. 6 pls. 5 yds. 9 in.
 (6) 2230 $\frac{8}{9}$ $\frac{5}{8}$.

EXERCISE LII.

- | | | |
|--------------|---------------|----------|
| (1) 25. | (2) 92, 36. | (3) 84. |
| (4) 12s. 6d. | (5) 40 miles. | (6) 250. |

EXERCISE LIII.

- | | | |
|-------------------|--------------------------|----------|
| (1) £30 16s. 6d. | (2) 8d. | (3) 240. |
| (4) 205501½ ft. | (5) 67 yrs. 4838400 sec. | |
| (6) £58 16s. 0¾d. | | |

EXERCISE LIV.

- | | | |
|--------------|--------------|------------------|
| (1) 120, 19. | (2) 117, 67. | (3) £26 7s. 7¼d. |
| (4) 176. | (5) 2s. 6d. | (6) 1s. 5¼d. |

EXERCISE LV.

- | | | |
|---|-----------|---------------------------------|
| (1) 51. | (2) 2700. | (3) 91 days 2184 hrs. 131040 m. |
| (4) 660 m. 5 fur. 22 pls. 3 yds. (5) 98½ guineas. | | |
| (6) 400½. | | |

EXERCISE LVI.

- | | | |
|------------------|---------------|------------------------|
| (1) £63 0s. 4¾d. | (2) 157. | (3) 288 bush. 3 pecks. |
| (4) 6¾. | (5) 9s. 11½d. | (6) 1 cwt. 11 lbs. |

EXERCISE LVII.

- | | | |
|---|-----------|--------------|
| (1) £4 15s. 6d. gain. | (2) 4400. | (3) 18½ lbs. |
| (4) 126 qrs. 5 bush. 2 pecks 2 qts. 1 pt. | | |
| (5) 20547 oz. 15 drs. 6¼ grs. | (6) 378½. | |

EXERCISE LVIII.

- | | |
|--|------------------------|
| (1) 60 miles. | (2) 5s. 3d. |
| (3) £7791 18s. 2½d., £14940 9s. 0½d., £22803 16s. 11½d.,
£45536 4s. 2½. | |
| (4) 2s. 8½d. | (5) John, 1 gal. ½ pt. |
| (6) 30 yrs. 10 mths. | |

EXERCISE LIX.

- (1) $\frac{1}{2}$ d. (2) 8s. 6d. (3) £3 5s., £9 15s.
 (4) 13 a. 1 rd. 34 pls. 30 yds. 5 ft.
 (5) 637 tons 19 cwts. 1 qr. 3 lbs. 1 oz. $13\frac{3}{4}$ drs.
 (6) £26 15s. 0 $\frac{1}{2}$ d.

EXERCISE LX.

- (1) 40 days. (2) £48 12s. 6d., £40. (3) 150.
(4) 29. (5) 64. (6) 1488 hra.

EXERCISE LXI.

- (1) 145881529087.
 (2) Seven billion one hundred and six million, five hundred and ninety-seven thousand and eighty-four.
 (3) 668, 467. (4) 142710883, 962 $\frac{1}{8}$ ¢.
 (5) 128 oz. (6) £84 18s.

EXERCISE LXII.

- (1) 380. (2) 19220. (3) 501 tons 1 cwt.
(4) £60, £10. (5) 418. (6) £1 11s. 8d.

EXERCISE LXIII.

- (1) £62 4s. 2½d. (2) £1 15s. 4d. (3) 28 cwts. 1 qr. 21 lbs. 11 oz.
(4) 30 lbs. 3 oz. 14 dwts. 13 grs. (5) 69 mths. 2 wks. 6 d. 3 hrs.
3 min. 44 sec.
(6) 1 qr. 17 lbs. 14 oz.

EXERCISE LXIV.

- (1) 100. (2) 10080. (3) 25.
(4) 4 oz. each. (5) £16 12s. 3d. (6) 18 qrs. 1 bush. 3 pks.

EXERCISE LXV.

- (1) 90 a. 23 pls. (2) 131 gals. 2 qts., 77 a. 14 pls.
(3) 43 yds. 2 ft. 11½ in., 15 yrs. 10 m. 3 wks.
(4) 53 yrs. (5) 104 wks. 1 day. (6) 31036.

EXERCISE LXVI.

- | | |
|-------------------------------|--------------|
| (1) Bullocks £103 5s. | (2) 58 left. |
| (3) £141 15s. | (4) 16s. 8d. |
| (5) £1 4s. 8 $\frac{1}{2}$ d. | (6) 48. |

EXERCISE LXVII.

- (1) Four hundred million, forty thousand and forty. Nine hundred and ninety-nine thousand, eight hundred and ninety-nine.
- | | |
|-----------------------------|--------------------------------------|
| (2) 2041 + 17. | (3) £6 6s. 7d. |
| (4) 19 yrs. 3 mths. 4 days. | (5) 161 tons. 6 cwts. 2 qrs. 12 lbs. |
| (6) 33 m. 3 f. 10 p. | |

EXERCISE LXVIII.

- | | |
|--------------------------------------|-------------------|
| (1) 13 qrs. 1 bush. | (2) £1058 8s. |
| (3) 13 @ 2s. each., one 3s., one 4s. | |
| (4) 10 oz. 13 $\frac{1}{2}$ drs. | (5) £222 17s. 6d. |
| (6) £5 2s. 6d. | |

EXERCISE LXIX.

- | | |
|------------------------------------|-------------------------------------|
| (1) 187871 $\frac{7}{8}$. | (2) 16 days. |
| (3) £72644 13s. 5 $\frac{1}{2}$ d. | (4) 96 tons. 14 cwts. 1 qr. 24 lbs. |
| (5) 485 lbs. 8 oz. | (6) 13 cwts. 2 qrs. 6 lbs. |

EXERCISE LXX.

- | | |
|--|------------------------|
| (1) 10 coins each = 5s. 5d. | (2) £3. |
| (3) £110. | (4) 2 $\frac{1}{2}$ d. |
| (6) £1 by 1st and 2nd, 10s. less by 3rd class. | (5) 57. |

EXERCISE LXXI.

- | | |
|---|------------------------|
| (1) 87, 119. | (2) A 90, B 70, C 100. |
| (3) £45589 3s. 3d., £73811 0s. 6d., £246036 15s. | |
| (4) 453 a. 2 rds. 16 pls., 1020 a. 2 rds. 16 pls., 2041 a. 32 pls. | |
| (5) £12 6s. 10 $\frac{1}{2}$ d. + 137 ; 12 cwts. 1 qr. 23 lbs. 6 oz. 3 drs. + 70. | |
| (6) £4 15s. 1d. | |

EXERCISE LXXII.

- (1) 114, $14\frac{1}{4}$. (2) John 7, Thomas 13. (3) 10 oz. $13\frac{1}{2}$ drs.
 (4) 10 tons 6 cwts. 1 qr. 10 lbs., 4 tons 11 cwts. 26 lbs.
 (5) £4 4s. 8d. (6) 11, 7 oz.

EXERCISE LXXIII.

- (1) 5003689 $\frac{1}{4}$. (2) 2 tons 10 cwts. 11 lbs. 14 oz.
 (3) 176062 $\frac{1}{2}$ miles. (4) £161536 11s.
 (5) £39525 2s. 9 $\frac{1}{2}$ d. (6) 3675 yds. 0 qr. 1 nl.

EXERCISE LXXIV.

- (1) 7 gals. 2 qts. (2) 19. (3) £120 19s. 10d.
 (4) 1 qr. 6 lbs. 5 oz. (5) £11 18s. 6d. (6) 20 m.

EXERCISE LXXV.

- (1) 2441581 $\frac{1}{5}$. (2) £165 8s. (3) 275 a., £1320.
 (4) 199 tons 8 cwts. 3 qrs. 17 lbs. 4 ozs. 6 dr. (5) 107032 $\frac{1}{3}$ $\frac{1}{11}$.
 (6) £66 12s. 2d.

EXERCISE LXXVI.

- (1) 10 pls. 3 yds. 2 ft. 126 in. (2) 138.
 (3) £21 8s. 6d. (4) 148.
 (5) 1 ton 8 cwts. 3 qrs. 5 lbs. (6) £2 18s. 5d.

EXERCISE LXXVII.

- (1) 567. (2) 92; 236.
 (3) Son, £456 1s. 10 $\frac{1}{2}$ d.; daughter, £912 3s. 9d.
 (4) 6 cwts. 2 qrs.; £463 16s. 0 $\frac{1}{2}$ d.
 (5) 14 tons 1 cwt. 1 qr. 22 lbs. 6 oz.
 (6) £89 18s. 4 $\frac{1}{2}$ d.

EXERCISE LXXVIII.

- (1) 74. (2) 40 yds. (3) 3s., 4s. 6d.
 (4) 51. (5) £1 12s. 6d.
 (6) Each son, 400 a. 0 rd. 20 pls.; daughter, 266 a. 3 rds.

EXERCISE LXXIX.

- | | |
|---|--------------------------------|
| (1) 188019972. | (2) 166363531200, 69742850854. |
| (3) 72642735. | (4) £10569 13s. 4d. |
| (5) 818938 $\frac{7}{8}$, 29030852 $\frac{7}{8}$. | (6) 7126 + 45, £100. |

EXERCISE LXXX.

- | | | |
|--------------------------------|---------------|-------------------------------|
| (1) £9 10s. 7 $\frac{1}{2}$ d. | (2) 7d. | (3) £5 5s. 3 $\frac{3}{4}$ d. |
| (4) £94 11s. 2d. | (5) 2 quarts. | (6) 1s. 1 $\frac{1}{2}$ d. |

EXERCISE LXXXI.

- | | |
|--|---|
| (1) £26 19s. 5 $\frac{1}{2}$ d., £10 1s. | (2) £1 1s. 1 $\frac{1}{4}$ d., £19 4s. 0 $\frac{3}{4}$ d. |
| (3) £15 5s. 6d., 22 a. 12 pls. | (4) 390 miles. |
| (5) £4 12s. 6d., £2491 13s. 9 $\frac{3}{4}$ d. + 11. | (6) £300. |

EXERCISE LXXXII.

- | | | |
|------------|---------|-----------------|
| (1) £1500. | (2) 59. | (3) 12. |
| (4) 13. | (5) £8. | (6) 6 bedrooms. |

EXERCISE LXXXIII.

- | | |
|---|---------------------------------|
| (1) 6684 75652 $\frac{1}{4}$. | (2) 6 yds. 3 qrs. |
| (3) £2 12s. day, £18 5s. week. | (4) £7 14s. 10 $\frac{1}{2}$ d. |
| (5) 23333 halfpence, £36 12s. 4 $\frac{1}{4}$ d. | |
| (6) 482 crowns, 28920d., 449 half-crowns, 2245 sixpences. | |

EXERCISE LXXXIV.

- | | | |
|------------------------|---------|------------------------|
| (1) 1 $\frac{3}{4}$ d. | (2) 9d. | (3) 336 half-crowns. |
| (4) 130. | (5) 28. | (6) 1 $\frac{1}{2}$ d. |

EXERCISE LXXXV.

- | | |
|-------------------------------|---|
| (1) 5. | (2) 4560d., 9120 halfpence, 175392 halfpence. |
| (3) 73817 drs.; 1850 cu. ft. | (4) 360 sixpences, 1064 crowns. |
| (5) 756s. 36 guin.; 800 guin. | (6) £43 0s. 9d. |

EXERCISE LXXXVI.

- | | |
|---------------------------------|-----------------|
| (1) 2156 halfpence. | (2) £2 14s. 2d. |
| (3) £17 3s. 11 $\frac{1}{2}$ d. | (4) 190080. |
| (5) 34. | (6) £41 15s. |

EXERCISE LXXXVII.

- | | |
|-----------------------------------|------------------|
| (1) 15 miles, £95. | (2) 814021 + £6. |
| (3) 9865½ half-crowns, 34340 far. | (4) 214552. |
| (5) 726 yds., 7311 nls. | (6) 23 spoons. |

EXERCISE LXXXVIII.

- | | |
|--|------------------------|
| (1) 9s. 1½d. | (2) £1 0s. 2¼d. |
| (3) Captain £325, mate £65, each man £17 6s. 8d. | |
| (4) £9 3s. 9d. | (5) 192. (6) £147 10s. |

EXERCISE LXXXIX.

- | | |
|--|--------------------------------|
| (1) £20 3s. | (2) £191 12s. 6d. |
| (3) 428 tons 4 cwts. 13 lbs. 11 oz.; 13 a. 12 pls. 17 yds. 5 ft. | |
| (4) 42240. | (5) 18, 8. (6) 10 hrs. 25 min. |

EXERCISE XC.

- | | | |
|--------------------|--|-----------|
| (1) £1 16s. 8¾d. | (2) 13 ⁸⁹ / ₁₇ . | (3) £260. |
| (4) 8s. 10¾d. | (5) £94 6s. 8d. | |
| (6) £191 14s. 3¾d. | | |

EXERCISE XCI.

- | | |
|--|--|
| (1) £138205 13s. 10d. | (2) £9 6s. 8d. |
| (3) £702 12s. 6d. | (4) 183492½ sq. yds., 294 half-crowns. |
| (5) £2052 15 ² / ₃ . | (6) £453 17s. 3d. |

EXERCISE XCII.

- | | | |
|-----------|---------------|--------------------|
| (1) £59 | (2) 1260 yds. | (3) 1551 m. 2 fur. |
| (4) 1579. | (5) 15552. | (6) 210. |

EXERCISE XCIII.

- | | |
|--|--|
| (1) 30660. | (2) 23 lbs. 2 oz. 12 dwts. |
| (3) £20000; 9¾d. | (4) £56 0s. 3d., £43 19s. 9d., £1 0s. 0½d. |
| (5) 2016 scr., 672 dr., 84 oz., 7 lbs.; 92576 scr. | |
| (6) 184 days; 4632 hrs. | |

EXERCISE XCIV.

- (1) £112 14s. 6d. ; £59 15s. ; $3\frac{1}{8}\frac{3}{4}$. (2) 1s. 6d. ; 9d. ; 6d.
 (3) A., £62 15s. $4\frac{1}{2}$ d. ; B., £37 2s. $9\frac{1}{2}$ d. ; C., £294 19s. 8d.
 (4) £23 15s. 2d. (5) £764 8s.
 (6) Master, £2 5s. ; each man, £1 10s.

EXERCISE XCV.

- (1) 9900. (2) 13702040 yds. ; £333 7s. $4\frac{1}{2}$ d.
 (3) 55 cwts. 3 qrs. 6 lbs. (4) 121.
 (5) 2625 ; £393 0s. 6d. (6) 3s. $2\frac{1}{2}$ d. ; £332.

EXERCISE XCVI.

- (1) 3s. 6d. (2) £12 17s. 6d.
 (3) 63360 halfpence = £132. (4) £2290.
 (5) £40. (6) 7s. 6d.

EXERCISE XCVII.

- (1) 3728 far. ; 29 lbs. 2 oz. (2) $133218\frac{9}{13}$.
 (3) 3 yds. 1 ft. ; £153 13s. $1\frac{1}{2}$ d. (4) 87 ; 9.
 (5) 6 clerks ; 2 tons 6 cwts. 26 lbs. (6) £47 3s. 11d.

EXERCISE XCVIII.

- (1) £114. (2) 27. (3) 660.
 (4) 25 miles. (5) At 3 P.M. ; 125 miles. (6) 1144.

EXERCISE XCIX.

- (1) 156 qrs. 2 bush. ; 240 fur. (2) $45011752 + 2d.$; 5020 guineas.
 (3) 34830, 84, 7560, 151 farthings : sum = 42474, quotient = $281\frac{4}{11}$.
 (4) 1 cwt. 3 qrs. $22\frac{1}{2}$ lbs ; £538 8s. 4d.
 (5) $6\frac{1}{2}$ d., 8s. $2\frac{1}{2}$ d. (6) 34.

EXERCISE C.

- (1) 29 min. 40 sec. (2) 67200.
 (3) 962. (4) 39 weeks.
 (5) 13s. 4d. too much. (6) 41.

SECOND PART.

EXERCISE CI.

- (1) 1008 ; 924. (2) $\frac{216112336}{304}$ 318 1008, greatest 2, least $\frac{2}{3}$.
 (3) $1\frac{1}{8}$, $\frac{5}{8}$, $1\frac{1}{4}$, $\frac{6}{8}$. (4) $\frac{3}{8}$, $6\frac{1}{2}$, 2, $6\frac{1}{5}$, $1\frac{1}{13}$.
 (5) £1033 0s. $11\frac{1}{2}$ d. ; £4 10s. (6) 3.

EXERCISE CII.

- (1) 729 ; 36. (2) $\frac{3}{11}$, $\frac{68}{123}$, $\frac{243}{277}$, $\frac{747}{949}$.
 (3) $3\frac{109}{318}$; $3\frac{201}{220}$. (4) $1\frac{1}{12}$, $\frac{1}{4}$; £4 8s.
 (5) $2\frac{5}{8}$, 7, $2\frac{2}{3}$, 1 ; $3\frac{6}{8}$, $3\frac{7}{4}$, $1\frac{3}{6}$, $\frac{5}{4}$. (6) £407 18s. $4\frac{1}{2}$ d.

EXERCISE CIII.

- (1) 11 ; 2016. (2) $\frac{17}{31}$, $\frac{7}{91}$, $\frac{89}{280}$, $\frac{8}{21}$, $\frac{2}{3}$.
 (3) $2\frac{24728}{4720}$; $\frac{1}{4}$. (4) $1\frac{9}{15}$, $\frac{1}{8}$, $\frac{3}{4}$.
 (5) £985 10s. $10\frac{1}{2}$ d. (6) £25 5s. $9\frac{3}{8}$ d., £1 12s. 6d.

EXERCISE CIV.

- (1) 18561 qrs. 7 bush. 1 pk. 1 gal. 1 qt. 1 pt. ; 2 a. 3 rds. 2 pls.
 18 yds. 8 ft. 72 in.
 (2) £1 2s. 6d. (3) $\frac{7}{216}$, $1\frac{3}{8}$. (4) $\frac{253}{288}$, $\frac{1222}{2753}$, $\frac{128}{147}$.
 (5) 20 ; $5\frac{1}{10}$. (6) 28800 times ; 5 hours.

EXERCISE CV.

- (1) $\frac{197}{117}$, $\frac{18}{16}$, $\frac{7}{27}$. (2) $\frac{221}{72}$, $\frac{180}{23}$, $\frac{253}{17}$, $\frac{4811}{941}$, $\frac{6287}{180}$, $5\frac{1}{3}$, $24\frac{1}{2}$, $34\frac{21}{26}$.
 (3) $\frac{280426}{260}$ 25 15 ; £30 0s. $7\frac{1}{32}$ d. (4) $12345\frac{8}{11}$; 31250.
 (5) 2 qrs. 24 lbs. (6) 115.

EXERCISE CVI.

- (1) $10\frac{33}{80}$; $2\frac{9}{128}$. (2) $2\frac{223}{318}$; £1 10s. 9d.
 (3) 1 lb. 10 oz. 16 drs. $15\frac{1}{2}$ grs. ; 135 mls. 30 pls. (4) £1 11s. 2d.
 (5) $33\frac{17}{112}$, $76\frac{321}{1144}$, $94\frac{9}{12}$. (6) £12 4s. $0\frac{1}{2}$ d.

EXERCISE CVII.

- (1) 16 cwt. 1 qr. 11 lbs. (2) 8 oz. 8 dwts. 8 grs.
 (3) $7\frac{1}{2}$ d., 17s. 6d., 1s. 3d., 1s. 10d. (4) $\frac{1}{3}\frac{1}{3}\frac{1}{3}$; 1.
 (5) £1030 3s. 9d.; 1000 threepences; 12000 farthings.
 (6) 91 mls. 3 fur. 15 pls. 5 yds. 1 ft. 3 in.; 34940585 sq. in.

EXERCISE CVIII.

- (1) $2\frac{3}{4}$, $1\frac{1}{8}$, $\frac{27}{256}$. (2) $84\frac{1}{2}$, $96\frac{1}{3}$, $100\frac{1}{5}$, $346\frac{7}{120}$.
 (3) $\frac{549}{852}$, $\frac{294}{852}$, $\frac{749}{852}$, $\frac{917}{852}$, $\frac{398}{852}$; 88. (4) $1\frac{1}{11}$; 2310.
 (5) £1 8s. 6d. (6) 66 half-sovs., 132 sixpences.

EXERCISE CIX.

- (1) $\frac{39}{180}$. (2) $10\frac{1}{2}$; 440 yds. 1 ft. 9 in.
 (3) 1 day 18 hrs. 10 m.; $1\frac{1}{5}$. (4) $1\frac{1}{4}$, $4\frac{3}{4}$.
 (5) £9 1s. $1\frac{3}{4}$, £4 8s. $5\frac{1}{5}$, $10\frac{3}{5}$. (6) £52 16s. $7\frac{1}{2}$ d.; 3s. $7\frac{1}{2}$ d.

EXERCISE CX.

- (1) $24\frac{1}{2}$, $72\frac{1}{3}$. (2) $\frac{39}{8}$.
 (3) $\frac{61}{480}$, $4\frac{67}{40}$. (4) £14 10s.
 (5) £31 13s. $54\frac{5}{9}$. (6) $\frac{1}{2}\frac{1}{4}$; $\frac{7}{8}$.

EXERCISE CXI.

- (1) $\frac{1}{2}\frac{1}{3}$; $\frac{9}{16}$. (2) 15 cwt. 6 lbs.
 (3) £2000. (4) 1 cwt. 1 qr. 16 lbs.
 (5) $\frac{228}{5831}$; $5\frac{2}{5}$; $914\frac{38}{8085}$. (6) £12 5s. $11\frac{1}{4}$ d.

EXERCISE CXII.

- (1) $1\frac{6}{11}$; 1; $1\frac{1}{5}$. (2) $24\frac{1}{2}$, $3\frac{1}{4}$.
 (3) $14\frac{1}{2}$. (4) £1 3s. 4d.
 (5) $5865\frac{63}{185}$. (6) $10\frac{1}{2}$; 6s. 3d.

EXERCISE CXIII.

- (1) 162261; £13 10s. 9d. (2) £18 0s. 5d.
 (3) 484. (4) $\frac{23}{302}$; £708 18s. $4\frac{1}{4}$ d.
 (5) $16\frac{1}{2}$; $\frac{581}{1296}$. (6) $5\frac{3}{19}$; $4\frac{1}{17}$.

EXERCISE CXIV.

- (1) $25\frac{30}{100}\frac{11}{100}\frac{4}{100}\frac{5}{100}$. (2) 18s. 1d.
 (3) £3 16s. 11½d. ; 10 cwt. 2 qrs. 27 lbs. 9 oz. 4¾ drs.
 (4) $\frac{17}{80}$; £100. (5) $2\frac{67}{100}$; 101 a. 1 rd. 35 pls. $27\frac{1}{2}$ yds.
 (6) $44118\frac{1}{100}\frac{1}{100}$.

EXERCISE CXV.

- (1) £1274 4s. 11d. (2) 2 miles.
 (3) £4 10s. (4) £2 19s. $2\frac{1}{2}$ d.
 (5) $\frac{268}{133}\frac{5}{28}$; $8\frac{5}{17}$. (6) £10.

EXERCISE CXVI.

- (1) 1430891. (2) 36530333. (3) £91 19s. $9\frac{8}{9}$.
 (4) $\frac{61}{212}$. (5) $\frac{1}{10}$ or $\frac{186}{1000}$; $\frac{1}{10}$ or $\frac{157}{1000}$; $\frac{5}{7}$ or $\frac{142}{1000}$; $\frac{137}{1000}$.
 (6) 60 a. ; £312 14s. 8d.

EXERCISE CXVII.

- (1) 28415427. (2) 98. (3) $\frac{32}{147}$. (4) $\frac{301}{818}$.
 (5) 24 mls. $1466\frac{6}{11}$ yds. ; $\frac{1}{3}$ farthing. (6) £28 7s.

EXERCISE CXVIII.

- (1) 254106. (2) £24 19s. $0\frac{3}{4}$ d.
 (3) 12000, 8000, 6120, 4800. (4) 259.
 (5) £9 13s. $9\frac{1}{4}$ d. (6) $\frac{123}{100}\frac{2}{100}$.

EXERCISE CXIX.

- (1) 124614 oz. ; 865170 in. (2) £4572 7s. $0\frac{3}{4}\frac{1}{4}$ d.
 (3) 1530 ; $\frac{8}{9}$. (4) £4 19s. $9\frac{1}{2}$ d.
 (5) £1600. (6) 20942361.

EXERCISE CXX.

- (1) 160, 138, 314. (2) 82113.
 (3) $1\frac{732}{1000}\frac{2}{100}$. (4) $\frac{1}{2}$, $\frac{2}{3}$, $\frac{107}{1000}$, $8\frac{2}{3}$, $26\frac{1}{2}$, $\frac{1}{200}$.
 (5) .5, .06, .008, .216, 37.0003, 8.001, 45.7853.
 (6) 29.962, 12.962, 182.427, 2.524941.

EXERCISE CXXI.

- (1) $\cdot 875$, $\cdot 6$, $\cdot 5$, $\cdot 7$, $\cdot 75$; $\frac{2}{3}$, $\frac{5}{10}$, $\frac{87}{100}$, $\frac{27}{100}$, $\frac{197}{125}$.
 (2) $864\cdot 27$, $8\cdot 6427$, $6849\cdot 5$, $\cdot 68495$, $652467\cdot 3$, $\cdot 6524673$, 3964920 ,
 $3\cdot 96492$, $154\cdot 922$, $17\cdot 932$, $4617\cdot 3873$, $3312\cdot 4527$.
 (3) $361\cdot 40293$, $87\cdot 7$. (4) $9\frac{1}{2}$ d.
 (5) $318375\cdot 58$, $\cdot 00031837568$. (6) $344\cdot 32994103$.

EXERCISE CXXII.

- (1) 10s. (2) 868599 ; 37460244 .
 (3) $5\cdot 55$, $20\cdot 0528$, $9\cdot 925$, $2\cdot 076$, $10\cdot 88235294$.
 (4) $\pounds 11932$ 8s. $10\frac{1}{2}$ d. (5) $16\frac{789}{1320}$, $\frac{872}{1878}$.
 (6) $\cdot 084316$, $\cdot 84316$, $8\cdot 4316$, $843\cdot 16$, $8431\cdot 6$, 200 .

EXERCISE CXXIII.

- (1) 80; 1008. (2) $\pounds 15$, $\pounds 20$, $\pounds 25$.
 (3) $\pounds 16$ 12s. $5\frac{1}{2}$ d.; 4 mls. 3 fur. $64\frac{1}{3}$ yds.
 (4) $24\frac{1}{2}$ c. ft.; $1\frac{1}{2}$ E.E. (5) 10, 145500, $289\cdot 4318$.
 (6) $\pounds 2801$ 10s.; 5 a. 0 rd. $4\frac{8}{13}$ pls.

EXERCISE CXXIV.

- (1) $\pounds 31$ 15s. $6\frac{1}{2}$ d. (2) 35 cwts. 2 qrs. 24 lbs.; $\pounds 8$ 6s. 8d.
 (3) $\frac{418}{115}$, $34\frac{7}{10}$, $694\frac{199}{115}$, $\frac{23}{115}$, $\frac{217}{115}$, $2\frac{7}{2}$.
 (4) 15s. 6d., 12s. 9d., 2s. 6d., 9d., 3d., 11·1d.
 (5) $\pounds 1$ 10s. $1\frac{1}{2}$ d. (6) $\pounds 3720$.

EXERCISE CXXV.

- (1) $\frac{23}{8}$. (2) $\cdot 00994318$, $\cdot 790625$. (3) $\frac{1}{8}$.
 (4) $8\frac{1}{8}$. (5) $3\cdot 818264$, $8\frac{571}{1350}$. (6) $\pounds 300$.

EXERCISE CXXVI.

- (1) $14\frac{2}{3}$ m. (2) $1\cdot 23$ nearly; $\pounds 3$. (3) $3\frac{1}{2}$, $1\frac{1}{8}$, $\frac{27}{12}$.
 (4) A. $\pounds 142$ 11s. 6d., B. $\pounds 238$ 5s. 1d., C. $\pounds 259$ 10s. 9d.
 (5) 11s. 6d.; 3 qrs. 8 lbs. (6) $38\cdot 4$.

EXERCISE CXXVII.

- (1) £927 18s. 9d. (2) 37460248 ; 1 fur. 9 pls. 4 yds. 1 ft. 6 in.
 (3) $\frac{4}{5}$, $\frac{1}{6}$; £21 0s. 5·6592d.; 2 hrs. 13 m. 37·92 sec.
 (4) $9\frac{2}{3}$ days. (5) 6158·168 ; 2309·313.
 (6) ·984375 bush.; ·037890625 tons.

EXERCISE CXXVIII.

- (1) $1\frac{1}{8}$ groat; $\frac{1}{8}$ perch. (2) $1\frac{1}{7}$.
 (3) 32, 8, 50, 90. (4) £4 14s. $6\frac{1}{8}$ d.
 (5) 4s. 9d.; ·009990530. (6) $600\frac{1}{6}$, $\frac{1}{6}$.

EXERCISE CXXIX.

- (1) £70 7s. 6d. (2) £1 11s.
 (3) £79 4s. $1\frac{1}{2}$ d.; 1144 $\frac{2}{3}$, 146 $\frac{88}{11}$. (4) $23\frac{5}{6}$, 7s. 3d.
 (5) 65750·25, 657·5025, 1813·8, 58·431681. (6) $4\frac{2}{3}$ days.

EXERCISE CXXX.

- (1) 40. (2) 19030 $\frac{2}{7}$. (3) 60 pence.
 (4) $\frac{5}{8}$. (5) 1 gal., out of 6 gals., or $\frac{1}{6}$ of the whole.
 (6) A £107 8s. $11\frac{1}{2}$ d., B £128 18s. 9d., C £103 3s.;
 total £339 10s. $8\frac{1}{2}$ d.

THIRD PART.

EXERCISE CXXXI.

- (1) 2341. (2) £4 17s. 2d.
 (3) £79 11s. $3\frac{2}{18}$. (4) 3·28.
 (5) $59\frac{1}{3}$ days. (6) £17 19s. $8\frac{2}{3}$.

EXERCISE CXXXII.

- | | |
|-------------------|--|
| (1) 3524·545 yrs. | (2) 299 + 1175 sq. yds. |
| (3) 2218·1362. | (4) 3811 $\frac{2}{3}$ $\frac{2}{3}$. |
| (5) £118 10s. | (6) £31 0s. 7 $\frac{7}{10}$. |

EXERCISE CXXXIII.

- | | |
|------------------------------------|--|
| (1) 38 yds. 1 ft. 6 in. | (2) $\frac{96000}{130}$. |
| (3) 30 gals. | (4) £1 7s. 10 $\frac{4}{5}$ d. |
| (5) 15 cwts. 11 $\frac{3}{4}$ lbs. | (6) 3 $\frac{1}{2}$ hrs.; 131 $\frac{1}{4}$ miles. |

EXERCISE CXXXIV.

- | | |
|--------------------------------|---------------------------|
| (1) 11 days. | (2) 19 $\frac{41}{130}$. |
| (3) £4 6s. | (4) 1·5472 days. |
| (5) £9 9s. 10 $\frac{1}{2}$ d. | (6) 1 $\frac{1}{5}$ yds. |

EXERCISE CXXXV.

- | | |
|---|-----------------------------------|
| (1) $\frac{1}{31}$, $\frac{1}{30}$. | (2) 28, 21, 35. |
| (3) 1·800, 78125. | (4) £1573 16s. 8d.; £1124 3s. 4d. |
| (5) 1 hr. 49 m. 55 $\frac{50}{31}$ sec. | (6) 120. |

EXERCISE CXXXVI.

- | | |
|-----------------------------|------------------|
| (1) 19 cwts. 2 qrs. 21 lbs. | (2) £80. |
| (3) 18 $\frac{57}{176}$. | (4) 235 each. |
| (5) 25·6. | (6) £16 12s. 6d. |

EXERCISE CXXXVII.

- | | | |
|------------------|---------------------|-------------------------|
| (1) £60. | (2) £29706 19s. 6d. | (3) 67 packages + 2 oz. |
| (4) 79 + 21 yds. | (5) 16 lbs. | (6) 9, 12, 15, 18. |

EXERCISE CXXXVIII.

- | | |
|-------------|---|
| (1) £25 8s. | (2) 7 a. 1 rd. 34 pls. |
| (3) £13 5s. | (4) 3563 $\frac{3}{4}$. |
| (5) 1, 2. | (6) 4 tons 11 cwts. 2 qrs. 5 $\frac{118}{333}$ lbs. |

EXERCISE CXXXIX.

- | | |
|------------------------------|---------------------------------|
| (1) 3, 4. | (2) 114. |
| (3) 59 s., £4, 55 sixpences. | (4) 2 tons 1 cwt. 3 qrs. 4 lbs. |
| (5) $8\frac{3}{4}$ months. | (6) £96 16s. $8\frac{1}{2}$ d. |

EXERCISE CXL.

- | | |
|-------------------------------|--------------------------------------|
| (1) £5 18s. $1\frac{1}{2}$ d. | (2) £14·912. |
| (3) 51 each. | (4) £5 2s. 11d. |
| (5) 12, $7\frac{1}{2}$. | (6) 143 tons 15 cwts. 2 qrs. 24 lbs. |

EXERCISE CXLI.

- | | | |
|-----------------|--|-------------------------|
| (1) 20, 18, 15. | (2) $6\frac{3}{4}$, 4, $40\frac{1}{2}$, 6, 8, 9. | (3) 4. |
| (4) 6. | (5) £140 ; £210. | (6) $8\frac{2}{3}$ hrs. |

EXERCISE CXLII.

- | | |
|--|--|
| (1) ·109611742. | (2) 3 sq. mls. 237 a. 5 sq. pls. 28 sq. yds. 12 sq. ins. |
| (3) Captain £42 19s. $7\frac{86}{100}$ d., a chief mate £18 16s. $0\frac{33}{100}$ d., a second mate £12 17s. $10\frac{44}{100}$ d., a sailor £24 3s. $6\frac{24}{100}$ d. | |
| (4) $30\frac{3}{4}$. | (5) 4 cwts. (6) £537 13s. $10\frac{1918}{1000}$ d. |

EXERCISE CXLIII.

- | | | |
|--------------------------------------|----------------------------|---|
| (1) $\frac{1}{6}$, $\frac{1}{10}$. | (2) £5804 15s. ; £9175 5s. | (3) 39 ft. |
| (4) $38\frac{2}{5}$. | (5) 15 extra. | (6) $2\frac{1}{5}$, $2\frac{7}{10}$, $3\frac{2}{5}$. |

EXERCISE CXLIV.

- | | | |
|--------------------------------|---------------|---------------------------------|
| (1) £3 11s. 5d. | (2) 4s. 3d. | (3) £998 18s. $7\frac{1}{4}$ d. |
| (4) £53 19s. $3\frac{3}{4}$ d. | (5) 2340 lbs. | (6) $7\frac{1}{2}$ days. |

EXERCISE CXLV.

- | | |
|---|----------------------|
| (1) 23 cwts. 10·12 lbs. | (2) 1 cwt. ; 1 ft. |
| (3) 2 cwts. 3 qrs. $7\frac{19}{100}$ lbs. | (4) £3. |
| (5) 5 lbs. 12 oz. $2\frac{1}{2}$ dr. | (6) $5\frac{3}{8}$. |

EXERCISE CXLVI.

- | | | |
|---|-------------------------|---------------------------------|
| (1) February 4th ; $12\frac{1}{4}$ lbs. | (2) 51. | (3) £18 12s. 6d. |
| (4) £141 11s. $10\frac{1}{32}$ d. | (5) $9\frac{2}{9}$ hrs. | (6) 24 days $8\frac{2}{5}$ hrs. |

EXERCISE CXLVII.

- (1) 2 hrs. $51\frac{22}{314}$ min. (2) 1000. (3) $5\frac{3}{108}$.
 (4) 66 yds. 2 ft. (5) 50 yds. (6) £160.

EXERCISE CXLVIII.

- (1) 13200. (2) .00016; .59375.
 (3) 13 mls. 1 fur. 15 pls.; £12 12s. 1 $\frac{1}{2}$ d.
 (4) 1s. $\frac{3}{4}$ d.; 1s. $2\frac{7}{16}$ d.; 1s. $4\frac{1}{2}$ d.; 1s. $6\frac{9}{16}$ d.
 (5) $25\frac{5}{43}$. (6) 2s. $2\frac{1}{4}$ d.

EXERCISE CXLIX.

- (1) 3 sq. mls. 237 a. 5 pls. 28 yds. 12 ins. (3) 5.
 (2) 10900 $\frac{100}{187}$.
 (4) £4 6s. 3d.; £3 9s.; 17s. 3d.
 (5) £164 14s. $6\frac{1234}{801}$ d.; £219 15s. $5\frac{534}{801}$ d. (6) £483.

EXERCISE CL.

- (1) £37 3s. $4\frac{7}{10}$ d. (2) 34434 $\frac{11}{23}$. (3) 8s. $7\frac{1}{2}$ d.
 (4) $156\frac{3}{5}$. (5) 678461539615. (6) 6s. $10\frac{4}{5}$ d.

EXERCISE CLI.

- (1) 4 yds. 1 ft. $10\frac{46}{115}$.
 (2) £528 17s. 9d.; Thirty-one thousand seven hundred and thirty-three + 1d.
 (3) £1209 17 $7\frac{1}{18}$. (4) 16 yds.; £3 12s.
 (5) 1 hr. 36 min. $41\frac{1}{4}$ sec. (6) $15\frac{5}{8}$.

EXERCISE CLII.

- (1) $3\frac{1}{2}$ dys. (2) 1 hr. $42\frac{3}{4}$ min.
 (3) $30\frac{3}{5}$; £4 12s. 1d. (4) £583.
 (5) 35 days. (6) 7 lbs. of beef each; A, 8d.; B, 20d.

EXERCISE CLIII.

- (1) 2520. (2) 160 doz. $5\frac{1}{4}$ bot. (3) £257 16s. 3d.
 (4) 2892571428. (5) £7 3s. $4\frac{5}{8}$ d. (6) 960.

EXERCISE CLIV.

- (1) 583 tons 5 cwt. 3 qrs. 26 lbs. (2) $6\frac{3}{16}$ oz.
 (3) 12 cwt. 13 lbs. $5\frac{1}{2}$ oz. (4) 10 yrs. 51 wks. 3 days.
 (5) 1 wk. $4\frac{849}{1081}$ dys. (6) 2s. $8\frac{4}{13}$ d.

EXERCISE CLV.

- (1) 148 mls. 0 fur. 39 pls. ; 6 mls. 2 fur. 5 pls.
 (2) £38 5s. $4\frac{1}{2}$ d. (3) £4128 18s. 9d. (4) £1308 10s. 1d.
 (5) $83\frac{32}{147}$. (6) 32.

EXERCISE CLVI.

- (1) 1 ton 6 cwt. 16 lbs. (2) £17 1s. $7\frac{1}{2}$ d.
 (3) £3666 12s. ; £7197 8s. (4) 32.
 (5) £104 17s. $1\frac{1}{4}$. (6) $10\cdot46$; $40\cdot3476$; $62\cdot7$; $6\cdot72094$.

EXERCISE CLVII.

- (1) 6 yrs. 10 mths. 3 wks. (2) 1920000000 ; 242269.
 (3) 20s. (4) 3s. 2d. each gain ; £2 17s.
 (5) 7560 guineas. (6) $\frac{77771}{869440}$.

EXERCISE CLVIII.

- (1) 14 dwts. 12 grs. ; '000004 ; '00004 ; '0004.
 (2) $36\frac{9}{14}$. (3) $29\frac{3}{8}$. (4) $3\frac{1}{2}$ d.
 (5) £315 15s. 9d. (6) $2\frac{1344}{3328}$.

EXERCISE CLIX.

- (1) 2 drs. 2 sc. 8 grs. ; $\frac{49959}{3212807}$. (2) 1 gallon.
 (3) 6s. 8d. ; 5s. 3d. ; 5d. ; $\frac{1}{8}$ d. (4) £23 14s. $11\frac{127}{320}$ d.
 (5) $111\frac{1}{3}$. (6) £5 2s. 8d.

EXERCISE CLX.

- (1) $156\frac{3}{4}$; $88\frac{3}{8}$. (2) 12s. $10\frac{3}{4}$ d.
 (3) £9 11s. $4\frac{1}{2}$ d. (4) $120\frac{31}{41}$ yds.
 (5) £1 5s. $10\frac{3}{4}$ d. (6) £51 16s. $6\frac{3}{4}$ d.

FOURTH PART.

EXERCISE CLXI.

- (1) 138 mls. 3 fur. (2) 1485. (3) £63 6s. 11½d.
 (4) 152881 ; 61132·5625 ; $\frac{1}{4}$; 261.
 (5) 19683 ; 41063·625 ; $\frac{1}{27}$; 24.
 (6) (a) £71 12s. 10½d. ; £111 8s. 11d. ; £183 1s. 9½d.
 (b) £728 4s. 3d. ; £458 10s. 1d. ; £1456 8s. 6d.
 (c) £2641 10s. ; £4842 15s. ; £4167 14s.

EXERCISE CLXII.

- (1) 116 a. 2r. 34 p. (2) $1\frac{1}{2}$ days ; $\frac{2}{3}$; $\frac{1}{4}$; $\frac{1}{4}$.
 (3) ·15765 ; 15·768 ; 157·65 ; 1·5765.
 (4) $\frac{1}{20}$; $\frac{1}{480}$; $\frac{2}{3}$; $\frac{2}{15}$; (5) 874·583 ; 261.
 (6) (a) £46 9s. 3d. ; £54 4s. 1½d. ; £69 13s. 10½d.
 (b) £604 12s. 6d. ; £475 1s. 3d. ; £834 19s. 2d.
 (c) £2173 16s. 4d. ; £2533 5s. 4d. ; £4698 10s. 6d.

EXERCISE CLXIII.

- (1) 8 c. yds. 23 c. ft. 1628 c. in.
 (2) 1583 tons 5 cwts. 2 qrs. 2 lbs. 12 oz.
 (3) £10 7s. 2½d. (4) £3 8s. 2½d.
 (5) 747757·9729 ; $\frac{1}{81}$; 9·0319. (6) ·896.

EXERCISE CLXIV.

- (1) 5 tons 11 cwts. 1 qr. 8 lbs. 12 oz. (2) 22.
 (3) $6\frac{1}{2}$; $6\frac{1}{8}$; $7\frac{1}{8}$; '6 ; ·677083 ; ·7614583.
 (4) 120·49 yds.
 (5) 597160·402461 ; 597·160402461 ; ·597160402461 ; 135.
 (6) (a) £74 11s. 5d. ; £122 0s. 6d. ; £196 11s. 11d.
 (b) £2738 17s. 0d. ; £3252 7s. 8½d. ; £3531 13s. 6d.
 (c) £5209 18s. 4d. ; £5364 13s. 4d. ; £5663 17s.

EXERCISE CLXV.

- (1) 4 tons 6 cwt. 2 qrs. $9\frac{1}{2}$ lbs. (2) 5s. $10\frac{2}{3}$ d.
 (3) £850. (4) £78 0s. $8\frac{1}{2}$ d.
 (5) 789·0001, &c.
 (6) (a) £148 17s. $6\frac{1}{2}$ d.; £245 19s. 5d.; £291 5s. $7\frac{1}{2}$ d.
 (b) £777 18s. $5\frac{1}{2}$ d.; £954 2s. 9d.; £1147 10s. $10\frac{1}{2}$ d.
 (c) £28186 7s. 4d.; £28828 13s. 8d.; £29130 19s. 0d.

EXERCISE CLXVI.

- (1) 1440123 $\frac{3}{8}$; 7200619 $\frac{1}{3}$. (2) $1\frac{935}{2885}$.
 (3) £239 9s. $10\frac{3}{4}$ d. (4) 199 ft.; 2 r. $30\frac{1}{4}$ p.
 (5) 49; 20 ft. 1377 in.
 (6) (a) £203 0s. 0d.; £304 10s. 0d.; £290 19s. 4d.
 (b) £613 6s. 1d.; £1266 16s. 6d.; £2604 0s. 7d.
 (c) £16427 13s. 4d.; £19428 17s. 6d.; £23377 16s. 8d.

EXERCISE CLXVII.

- (1) 602 $\frac{48}{271}$ d. (2) $\frac{4849}{24750}$. (3) £508; £12 14s.
 (4) 166 $\frac{3}{4}$. (5) £637 10s.
 (6) (a) £144 14s. 2d.; £188 15s. 0d.; £245 7s. 6d.
 (b) £3064 7s. $10\frac{1}{2}$ d.; £2572 18s. $8\frac{1}{4}$ d.; £3324 11s. $6\frac{3}{4}$ d.
 (c) £18583 6s. 8d.; £43485 0s. 0d.; £8005 0s. 0d.

EXERCISE CLXVIII.

- (1) 7d. (2) £7390 18s. $2\frac{2}{11}$ d. (3) 1; 15.
 (4) 75 a. 2 rds. 20 pls. (5) 777; 193.
 (6) (a) £186 15s. 0d.; £141 2s. 0d.; £128 13s. 0d.
 (b) £733 18s. $5\frac{1}{4}$ d.; £1269 5s. $0\frac{3}{4}$ d.; £1217 8s. $11\frac{1}{4}$ d.
 (c) £26197 9s. 4d.; £8121 2s. 8d.; £5811 5s. 4d.

EXERCISE CLXIX.

- (1) 110; 3s. $11\frac{1}{2}$ d. (2) 34 qrs. 3 bush. 2 pks.
 (3) Gain £4 18s. (4) $\frac{333}{33880}$; 82886 +
 (5) 456; 301.
 (6) (a) £301 13s. 9d.; £331 17s. $1\frac{1}{2}$ d.; £392 3s. $10\frac{1}{2}$ d.
 (b) £422 17s. 10d.; £852 12s. 1d.; £2550 19s. 10d.
 (c) £91254 6s. 8d.; £32837 9s. 4d.; £24769 4s. 8d.

EXERCISE CLXXX.

- (1) 15s. $5\frac{1}{2}$ d. (2) £27 2s. $2\frac{1}{4}$ d. (3) $4\frac{1}{4}$ d.
 (4) $21\frac{1}{4}$ q, 78264d. (5) 87 yds. 2 qrs. $2\frac{3}{4}$ nls.
 (6) (a) £91 0s. $11\frac{1}{4}$ d.; £119 6s. $1\frac{3}{8}$ d.; £147 11s. $3\frac{1}{4}$ d.
 (b) £773 12s. $4\frac{1}{4}$ d.; £931 15s. $3\frac{9}{32}$ d.; £1585 14s. $2\frac{1}{4}$ d.
 (c) £627743 13s. $0\frac{2}{4}$ d.; £545507 12s. $2\frac{1}{8}$ d.; £1020906 1s. $8\frac{2}{4}$ d.

EXERCISE CLXXXI.

- (1) £141 9s. $11\frac{7}{8}$ d. (2) $3\frac{3}{4}$ days.
 (3) £18 17s. $5\frac{1}{8}$ d. (4) 89·3824.
 (5) 05292d.; 000882 or $\frac{441}{500000}$. (6) £1 5s. $3\frac{1}{2}$ d.

EXERCISE CLXXXII.

- (1) $133 + 53$ (2) $1\frac{2}{3}$. (3) $1\frac{1}{2}$ d.
 (4) $4\frac{2}{3}$; $4\frac{1}{3}$. (5) 13s. $0\frac{1}{4}$ d. (6) £149 3s. $8\frac{1}{2}$ d.

EXERCISE CLXXXIII.

- (1) £670 10s. (2) 6s. $2\frac{7}{8}$ d. (3) £3470 13s. $4\frac{1}{2}$ d.
 (4) $2\frac{1}{8}$ d.; $9\frac{9}{32}$ s. (5) $219\frac{1}{8}$ d.; $\frac{7}{8}$ s. (6) £109 7s. 6d.

EXERCISE CLXXXIV.

- (1) Four miles behind. (2) £48 18s. $2\frac{1}{8}$ d.
 (3) £2578 10s. (4) $1\frac{3}{4}$ q.
 (5) $21\frac{2}{3}$; 2·35. (6) 6 days 3 hrs.

EXERCISE CLXXXV.

- (1) 12s. $3\frac{9}{32}$ d. (2) £33 18s. $4\frac{1}{2}$ d.
 (3) £5 8s. $5\frac{3}{4}$ d. (4) £3·406; £3 8s. 0·2796d.
 (5) 729; 1084. (6) 3 lbs. $11\frac{5}{12}$ oz.

EXERCISE CLXXXVI.

- (1) £5·203; £4 19s. 1·2384. (2) £1307 18s. $11\frac{1}{2}$ d.; £190 9s. $6\frac{1}{2}$ d.
 (3) 21 inches. (4) 6·122448 +
 (5) 801249 +; 0513 + (6) $8\frac{2}{3}$ dys.

EXERCISE CLXXXVII.

- (1) 21259 ; 590 yds. 1 ft. 7 in., or 2 fur. 27 pls. 2 yds.
 (2) £80074 19s. 1d. ; £14 17s. 11 $\frac{3}{4}$ d. (3) 18 ft. 6 in.
 (4) 19 $1\frac{1}{4}$; 12 $1\frac{3}{4}$; 57 $\frac{5}{8}$; 41 $\frac{1}{8}$. (5) 25 ft.
 (6) 584 $\frac{8}{135}$ weeks.

EXERCISE CLXXXVIII.

- (1) 3s. 7d. (2) £572 0s. 5 $\frac{8}{7}$. (3) 14 ft.
 (4) 1·828571 $\frac{1}{4}$. (5) 417·444, &c. (6) 11 $\frac{1}{4}$ lbs.

EXERCISE CLXXXIX.

- (1) £288 5s. ; £384 6s. 8d. ; £768 13s. 4d. ; £17 7s. 7 $\frac{5}{8}$ d.
 (2) 7d. (3) $\cdot\dot{6}$; $\cdot\dot{5}\dot{4}$; $\cdot\dot{2}$; $\frac{1}{8}\frac{8}{8}$; $\frac{2}{8}\frac{8}{8}$; $\frac{3}{8}\frac{8}{8}$.
 (4) £541 11s. 9 $\frac{3}{8}$ d. (5) 3 $1\frac{1}{3}$ d. (6) 9310404 ft.

EXERCISE CXC.

- (1) £26 19s. 9d. (2) £5385 19s. 5 $\frac{1}{2}$ d. (3) ·02518 ; ·68 $\dot{1}$.
 (4) £594 8s. ; £1040 4s. ; £1337 8s. ; £1486 ; £1733 4s. ; 2229.
 (5) 1 $\frac{5}{12}$ hours. (6) 62789 $\frac{3}{7}$.

FIFTH PART.

EXERCISE CXCI.

- (1) £65 1s. ; £81 6s. 3d. ; £97 11s. 6d. (2) £10 11s. 9 $\frac{3}{100}$ d.
 (3) £451 15s. 8 $\frac{4}{8}$ d. ; £530 14s. 0d. ; £427 17s. 3d.
 (4) £31 10s. 6d. ; £231 10s. 6d. ; £25 9s. 6d. ; £175 9s. 6d. ;
 £9 4s. ; £109 4s.
 (5) £7700. (6) £63 3s. 1 $\frac{1}{4}$.

EXERCISE CXCLII.

- (1) £104 18s. $1\frac{17}{10}$ d.; £134 17s. $6\frac{2}{10}$ d.; £164 17s. $0\frac{1}{10}$ d.
 (2) £10 11s. $9\frac{8}{10}$ d.
 (3) £4146 7s. $3\frac{1}{10}$ d.; £4453 7s. $10\frac{19}{10}$ d.; £1135 1s. $9\frac{1}{10}$ d.
 (4) £53 17s. 6d.; £303 17s. 6d.; £28 4s. 7d.; £228 4s. 7d.;
 £47 15s. 6d.; £347 15s. 6d.
 (5) £333 2s. $9\frac{2}{10}$ d. (6) £42 10s.

EXERCISE CXCLIII.

- (1) £57 10s. $4\frac{17}{10}$ d.; £120 5s. $3\frac{21}{10}$ d.; £130 14s. $4\frac{3}{10}$ d.
 (2) £14 1s. $9\frac{2}{10}$ d. (3) £814 8s. $7\frac{8}{10}$ d.; £700; £886 17s. 6d.
 (4) £31 3s. 9d.; £371 3s. 9d.; £40 5s. 7d.; £440 5s. 7d.;
 £35 18s. 1d.; £285 18s. 1d.
 (5) £30 11s. $7\frac{8}{10}$ d. (6) £8 1s. $3\frac{24}{10}$ d.

EXERCISE CXCLIV.

- (1) £102 8s. $11\frac{1}{10}$ d.; £141 16s. $11\frac{8}{10}$ d.; £181 5s. $0\frac{1}{10}$ d.
 (2) £187 18 $3\frac{4}{10}$ d.
 (3) £2024 10s. $9\frac{2}{10}$ d.; £2699 16 $0\frac{8}{10}$ d.; £1726 18s. $3\frac{18}{10}$ d.
 (4) £186 11s. 3d.; £1186 11s. 3d.; £725 2s. 8d.; £775 2s. 8d.;
 £60 7s. 10d.; £625 7s. 10d.
 (5) £99 15s.; £100. (6) $11\frac{1}{10}$ d.

EXERCISE CXCLV.

- (1) £18 10s. $6\frac{1}{10}$ d.; £21 12s. $3\frac{2}{10}$ d.; £27 15s. $9\frac{2}{10}$ d.
 (2) £216 19s. $11\frac{20}{10}$ d.
 (3) £702 6s. $11\frac{9}{10}$ d.; £624 8s. $0\frac{8}{10}$ d.; £326 17s. $10\frac{11}{10}$ d.
 (4) £49 15s. 1d.; £505 15s. 1d.; £50 1s. 1d.; £310 11s. 1d.;
 £627 5s. 8d.; £3589 0s. 8d.
 (5) £1 10s. (6) 100 shares; $15\frac{1}{4}$ per cent.

EXERCISE CXCLVI.

- (1) £251 18s. $5\frac{1}{10}$ d.; £350 17s. 10d.; £449 17s. $2\frac{3}{10}$ d.
 (2) £286 19s. $7\frac{2}{10}$ d. (3) $3\frac{1}{10}$; $7\frac{1}{10}$; $40\frac{19}{10}$ yrs.
 (4) £7 14s. $2\frac{1}{10}$ d. (5) £3 8s. $11\frac{2}{10}$ d.
 (6) £8 13s. $8\frac{1}{10}$ d.

EXERCISE CXCVII.

- (1) £321 6s. $11\frac{1}{2}$ d. ; £422 15s. $0\frac{2}{3}$ d. ; £591 5s. $7\frac{1}{10}$ d.
 (2) £145 7s. $7\frac{7}{10}$ d. (3) $2\frac{1}{2}$; $1\frac{8}{13}$; $3\frac{1}{2}$ yrs.
 (4) £281 7s. $6\frac{1}{2}$ d. (5) A, £329 10s. $7\frac{1}{2}$ d. ; B, £430 9s. $4\frac{1}{2}$ d.
 (6) £4068 1s. $8\frac{2}{9}$ d.

EXERCISE CXCVIII.

- (1) £659 5s. $9\frac{1}{6}$ d. ; £1086 1s. $2\frac{1}{4}$ d. ; £1324 9s. $3\frac{3}{8}$ d.
 (2) £4 16s. $8\frac{1}{10}$ d. (3) $11\frac{1}{10}$; $3\frac{1}{2}$; $4\frac{1}{2}$ yrs.
 (4) £2807 14s. $4\frac{1}{4}$ d. (5) £341 11s. $8\frac{1}{10}$ d. (6) $3\frac{1}{2}$.

EXERCISE CXCIX.

- (1) £146 11s. $4\frac{7}{100}$ d. ; £198 11s. $6\frac{2}{100}$ d. ; £252 3s. $2\frac{1}{10}$ d.
 (2) £20 7s. $8\frac{3}{8}$ d. (3) $4\frac{1}{2}$; $3\frac{1}{2}$; $1\frac{1}{10}$ yrs.
 (4) £783 7s. $9\frac{1}{2}$ d. (5) 16s. (6) £99 15s. $5\frac{1}{2}$ d.

EXERCISE CC.

- (1) £1447 18s. 5d. ; £1846 1s. $11\frac{1}{10}$ d. ; £2327 0s. $3\frac{1}{2}$ d.
 (2) £74 15s. $5\frac{5}{8}$ d. (3) $8\frac{1}{2}$; $2\frac{1}{2}$; $2\frac{1}{2}$ yrs.
 (4) £219 9s. $0\frac{1}{4}$ d. (5) £380 2s. $4\frac{1}{2}$ d.
 (6) £2704 18s. $4\frac{1}{2}$ d.

EXERCISE CCI.

- (1) £46 14s. $1\frac{1}{2}$ d. ; £62 5s. $6\frac{1}{10}$ d. ; £85 12s. $6\frac{1}{2}$ d.
 (2) 5 per cent. (3) £543 15s. ; £1998.
 (4) £181 $1\frac{1}{2}$ d. ; £112 $8\frac{1}{2}$ d. ; £302 $1\frac{1}{2}$ d.
 (5) 4s. ; 1s. (6) Increase 18s. $8\frac{1}{2}$ d. per cent.

EXERCISE CCII.

- (1) £72 15s. $10\frac{1}{2}$ d. ; £93 11s. $10\frac{1}{2}$ d. ; £109 3s. $10\frac{1}{2}$ d.
 (2) $13\frac{8}{11}$. (3) £683 1s. 6d. ; £374 13s. $4\frac{1}{2}$ d. ; £644 4s. $4\frac{1}{2}$ d.
 (4) £231 2s. $9\frac{1}{2}$ d. ; £333 8s. $9\frac{1}{2}$ d. ; £396 0s. $1\frac{1}{2}$ d.
 (5) 15s. (6) £8 4s. $7\frac{1}{2}$ d.

EXERCISE CCIII.

- (1) $4\frac{4}{5}\frac{6}{10}$. (2) Nil. (3) $\frac{1}{4}$ d. each.
 (4) £4 6s. $3\frac{1}{2}$ d.; £4 8s. $3\frac{3}{4}\frac{2}{4}$ d.; £4 4s. $8\frac{5}{8}\frac{3}{8}$ d.
 (5) £494 6s. $11\frac{9}{8}\frac{2}{8}$ d.; £609 13s. $10\frac{3}{4}\frac{2}{4}\frac{2}{4}$ d.; £756 7s. $0\frac{2}{8}\frac{2}{8}$ d.
 (6) $7\frac{4}{8}\frac{4}{8}$.

EXERCISE CCIV.

- (1) £32 17s. $6\frac{3}{8}\frac{8}{8}$ d.; £49 6s. $3\frac{4}{2}\frac{5}{2}$ d.; £68 9s. $9\frac{1}{2}\frac{1}{2}$ d.
 (2) $3\frac{1}{3}$. (3) $6\frac{2}{3}\frac{2}{3}$.
 (4) £211 5s. $3\frac{1}{2}$ d.; £117 8s. $4\frac{1}{2}$ d.; £265 3s. $1\frac{1}{2}$ d.
 (5) 50 per cent.; $12\frac{1}{2}$ per. cent. (6) £21428 11s. $5\frac{1}{2}$ d.

EXERCISE CCV.

- (1) £1629 17s. $4\frac{2}{4}\frac{7}{4}$ d.; £2173 16s. $2\frac{1}{2}\frac{3}{2}$ d.; £2469 9s. $11\frac{3}{8}\frac{3}{8}$ d.
 (2) $11\frac{1}{4}$. (3) $11\frac{1}{8}\frac{8}{8}$. (4) £1 10s. 2d.
 (5) £11 8s. $0\frac{7}{8}\frac{2}{8}$ d.; £3 5s. $1\frac{2}{8}\frac{7}{8}$ d.
 (6) Lose £1 10s. $8\frac{1}{4}\frac{3}{4}$ d. per annum.

EXERCISE CCVI.

- (1) £171 19s. $0\frac{5}{16}\frac{24}{16}\frac{3}{16}$ d.; £262 19s. $8\frac{2}{8}\frac{8}{8}\frac{2}{8}$ d.; £330 8s. $4\frac{5}{8}\frac{5}{8}\frac{7}{8}$ d.
 (2) $4\frac{1}{2}\frac{1}{2}\frac{1}{2}$. (3) £326 8s. $7\frac{1}{4}\frac{3}{4}\frac{1}{4}$ d. (4) $4\frac{4}{9}$ yrs.
 (5) £15150 $\frac{5}{10}\frac{0}{10}$. (6) £13041 13s. 4d.

EXERCISE CCVII.

- (1) £171 10s. $2\frac{4}{7}\frac{1}{7}$ d.; £231 10s. $9\frac{3}{8}\frac{1}{8}\frac{1}{8}$ d.; £265 16s. $10\frac{1}{2}\frac{1}{2}\frac{1}{2}$.
 (2) $3\frac{7}{8}\frac{9}{8}$. (3) £126 16s. $9\frac{8}{8}\frac{8}{8}\frac{8}{8}$ d. (4) £19 12s. $2\frac{1}{3}\frac{1}{3}$.
 (5) £226 17s. $11\frac{1}{4}\frac{8}{4}$ d. (6) £161 2s. $1\frac{1}{2}$ d.; £53 14s. $0\frac{1}{2}$ d.

EXERCISE CCVIII.

- (1) £36 4s. $4\frac{7}{10}\frac{0}{10}$ d.; £48 5s. $9\frac{7}{10}$ d.; £61 11s. $4\frac{3}{4}\frac{1}{4}$ d.
 (2) $3\frac{2}{8}\frac{2}{8}\frac{2}{8}$. (3) £3818 15s. $8\frac{1}{4}\frac{3}{4}$ d.
 (4) A, £23 16s. $5\frac{2}{8}\frac{2}{8}\frac{8}{8}$ d.; B, £425 14s. $2\frac{2}{8}\frac{3}{8}\frac{4}{8}$ d.; C, £584 17s. $6\frac{3}{8}\frac{3}{8}\frac{8}{8}$ d.;
 D, £331 5s. $10\frac{2}{8}\frac{3}{8}\frac{2}{8}$ d. Total, £1365 13s. $11\frac{1}{8}\frac{4}{8}\frac{1}{8}$ d.
 (5) £75 2s. $8\frac{3}{8}\frac{4}{8}$ d. (6) £4039 5s. $4\frac{9}{8}\frac{8}{8}$ d.

EXERCISE CCIX.

- (1) £1177 19s. $4\frac{1}{2}$ d. ; £1978 19s. 9d. ; £1696 5s. 6d.
 (2) $19\frac{1}{2}$. (3) £4761 12s. (4) £362 5s. $4\frac{1}{2}$ d.
 (5) £5 5s. $3\frac{1}{3}$ d. (6) £4650 8s. 9d. ; £201 5s.

EXERCISE CCX.

- (1) $12\frac{4}{13}$. (2) £5252 10s. $10\frac{178}{385}$.
 (3) Principal, £492 2s. $2\frac{1}{3}$ d. ; Interest, £12 9s. $5\frac{1081}{1080}$ d.
 (4) £1 5s. 1'609d. (5) £1400 2s. 6d. ; £1820 3s. 3d. ; £3220 5s. 9d.
 (6) £5137 10s.

SIXTH PART.

EXERCISE CCXI.

- | | | |
|-----------------------------------|------------------------------------|-----------------------------------|
| (1) 49 ft. | (2) 53 ft. 44 in. | (3) 33 ft. 143 in. |
| (4) 35 ft. 66 in. | (5) 47 ft. $99\frac{5}{8}$ in. | (6) 25 ft. 12 in. |
| (7) 88 ft. $139\frac{1}{2}$ in. | (8) 52 ft. 87 in. | (9) 62 ft. $6\frac{1}{2}$ in. |
| (10) 15 ft. $21\frac{3}{4}$ in. | (11) 17 ft. $86\frac{75}{144}$ in. | (12) 41 ft. $99\frac{1}{8}$ in. |
| (13) 18 ft. $90\frac{3}{4}$ in. | (14) 67 ft. $111\frac{1}{8}$ in. | (15) $193\frac{1}{8}$ ft. |
| (16) 24 ft. $82\frac{37}{44}$ in. | (17) 25 ft. $75\frac{19}{44}$ in. | (18) 106 ft. $141\frac{5}{9}$ in. |
| (19) 45 ft. $48\frac{1}{2}$ in. | (20) 101 ft. $140\frac{1}{2}$ in. | |

EXERCISE CCXII.

- | | | |
|---|---------------------------------|----------------------------------|
| (1) £11 18s. $11\frac{1}{2}$ | (2) 60 ft. 106 in. | (3) £2 5s. $6\frac{3}{4}$ d. |
| (4) £2 15s. $8\frac{2}{3}$. | (5) £2 7s. $10\frac{4}{5}$ d. | (6) £1 12s. $4\frac{5}{6}$. |
| (7) £12 19s. $11\frac{1}{4}$ d. | (8) 272 ft. 102 in. | (9) £89 15s. $1\frac{3}{4}$. |
| (10) 475 c. ft. 1560 c. in. ; £35 5s. $0\frac{9}{16}$. | (11) $1834\frac{1}{4}$ s. | |
| (12) £25 19s. 9d. | (13) 4 a. 4429 yds. 2 ft. | (14) £1 12s. 1d. |
| (15) £93 7s. $6\frac{5}{4}$ d. | (16) £15 12s. $1\frac{1}{2}$ d. | (17) 1 ft. 6 in. |
| (18) 10 ft. | (19) £9 11s. 4d. | (20) £18 6s. $4\frac{77}{88}$ d. |

EXERCISE CCXIII.

- (1) 4 a. 1'328 r. (2) 68 sq. ft. 126 sq. in.
 (3) 164 sq. ft. 72 sq. in. (4) 248 sq. ft. 90 sq. in.

EXERCISE CCXIV.

- (1) 48'99 ft. (2) 253'179 ft. (3) 103'6375 sq. ft.
 (4) 490'905 sq. yds. (5) 46'1 ft. (6) 188'9 miles.

EXERCISE CCXV.

- (1) 61 a. 1 r. 39'68 p. (2) 111'803, &c.
 (3) 9 a. 38 p. (4) 13 a. 1 r. 1 p.

EXERCISE CCXVI.

- (1) 1 a. (2) 88'3575. (3) 4033'8 sq. yds.
 (4) Nearly 56 yds. (5) 6 a. 1 r. 38 p. 16½ yds.
 (6) 28'27.

EXERCISE CCXVII.

- (1) 28'125 ft.; 7'68 in. (2) 1371½.
 (3) 182 sq. yds. 4 sq. ft. 40 sq. in.; 91 sq. yds. 2 sq. ft. 20 sq. in.
 (4) 750 sq. ft. 120 sq. in. (5) 60 ft. (6) 6 yds square.

EXERCISE CCXVIII.

- (1) 280 yds.; £245; 16 a. 24 p. (2) 1 a. 1 r. 15½ p.
 (3) 27½ sq. ft. (4) 32½ yds. (5) 23680000; 1: 100.
 (6) 490½ (7) 6½ ft. (8) 1 r. 11 p. 2 yds. 8½ ft.
 (9) 51½ c. ft.

EXERCISE CCXIX.

- (1) 28 ft. 6½ in. (2) 75'3984 yds.; 1246'0616 yds.
 (3) 67'544 ft.; 21 ft. 6 in. (4) 20168'09.
 (5) 3232½. (6) 65 tons 1 cwt. 16'515625 lbs.

EXERCISE CCXX.

- (1) 2625 c. ft. (2) £1 18s. 11'41d.
 (3) £17 9s. 8d. (4) 785'4 ft.
 (5) 59'19 ft. (6) 141'7647 sq. ft.; 15 ft. 6 in.

SEVENTH PART.

EXERCISE CCXXI.

- | | | |
|--------------------|---------------------|----------------------|
| (1) £76035 8s. 3d. | (2) £83532 3s. | (3) £67543 10s. 5d. |
| (4) 166711 4s. 1d. | (5) £136679 3s. 6d. | (6) £120002 1s. 10d. |

EXERCISE CCXXII.

- | | | |
|----------------------|----------------------|----------------------|
| (1) £140614 1s. 3d. | (2) £100186 3s. 5d. | (3) £105939 6s. 4d. |
| (4) £124895 16s. 4d. | (5) £100131 14s. 9d. | (6) £101410 10s. 1d. |

EXERCISE CCXXIII.

- | | | |
|---------------------|---------------------|----------------------|
| (1) £149360 19s. | (2) £128204 4s. 1d. | (3) £153398 8s. 11d. |
| (4) £92690 15s. 3d. | (5) £169424 9s. 3d. | (6) £83464 8s. 3d. |

EXERCISE CCXXIV.

- | | | |
|---------------------|---------------------|---------------------|
| (1) £77808 1s. | (2) £99117 14s. 8d. | (3) £81342 10s. 3d. |
| (4) £112969 2s. 7d. | (5) £84239 2s. 4d. | (6) £95653 4s. |

EXERCISE CCXXV.

- | | | |
|-----------------------|---------------------|------------------|
| (1) £97582 13s. 1d. | (2) £67832 14s. 7d. | (3) £103904 18s. |
| (4) £162427 13s. 10d. | (5) £156597 0s. 8d. | (6) £142542 16s. |

EXERCISE CCXXVI.

- | | | |
|---------------------|----------------------|---------------------|
| (1) £178391 6s. 2d. | (2) £122758 17s. 3d. | (3) £157824 7s. 4d. |
| (4) 149741 16s. 9d. | (5) £99529 9s. 8d. | (6) £227825 7s. 3d. |
| (7) 149003 5s. | (8) £124831 16s. 9d. | |

EXERCISE CCXXVII.

- | | | |
|-----------------------|-----------------------|----------------------|
| (1) £139286 19s. 11d. | (2) £122638 17s. 10d. | (3) £162191 13s. 8d. |
| (4) £112104 1s. 6d. | (5) £128445 7s. 11d. | (6) £117812 12s. 2d. |

EXERCISE CCXXVIII.

- (1) £132125 9s. 3d. (2) £110793 6s. 6d. (3) £137933 13s. 8d.
 (4) £116507 17s. 7d. (5) £144440 5s. 2d. (6) £147417 1s.

EIGHTH PART.

EXERCISE CCXXIX.

- (1) £4834 11s. 5½d. (2) £158 8s. 9d. (3) £180 19s. 7½d.
 (4) 40½. (5) £1 3s. 5¼d. (6) 350.
 (7) £91 18s. 6¾d. (8) £2 11s. 4d. (9) 17s. 2¼d.
 (10) 14½. (11) 55½. (12) £3 12s. 5¾d.
 (13) 1 hr. 45 min. 7½ sec. (14) 2½ yrs. (15) £17 3s. 9d.

EXERCISE CCXXX.

- (1) £83 1s. 11¼d.; £513 6s. 6¼d. (2) £22 11s. 1¼d.
 (3) 105 days. (4) £4538 15s. 10¾d.; £95 3s. 8¾d.
 (5) 13021 + 105; £9 1s. 9d. + 4s. 7¼d. (6) 100¾d.; 207¼d.
 (7) 17 days 4 hrs. 20 min.; 7s. 2d.
 (8) 73; 1; 2000; 2½; 11½; 8½.
 (9) 21½. (10) 9102d. (11) £211 9s. 8d.; 72 yds.
 (12) £640. (13) 247½. (14) £171 8s. 6¾d.
 (15) 1½ brandy, 1½ water ∴ per cent. = 18½ : 81½. (16) £189 3s.

EXERCISE CCXXXI.

- (1) 2. (2) 3 qrs. 3 lbs. 1½ oz.
 (3) 2 days 14 hrs. 30 min. (4) £25 14s. 6½d.
 (5) 4 per cent. (6) 2 at 2s. 3d.; 13 at 13s. 6d.
 (7) £945 3s. 4d. (8) 17·8253194.
 (9) 00994318. (10) £1 11s. 4·8d. (11) 14s.
 (12) Boots, 4541; price, 9s. 4½d. Shoes, 9082; price, 2s. 10½d.
 (13) 1600 lbs.

EXERCISE CCXXXII.

- (1) 27256867. (2) 5508. (3) £21 17s. 6 $\frac{1}{2}$ d.
 (4) 17 cwts. 1 qr. 12 $\frac{1}{2}$ lbs. (5) 72448 $\frac{3}{4}$. (6) 493056.
 (7) 21 $\frac{2}{3}$. (8) £3 2s. 9 $\frac{3}{4}$ d. (9) £54 9s. 4 $\frac{1}{8}$ d.
 (10) 17s.; 13s.; 10s. (11) 12 days. (12) £109 0s. 10 $\frac{3}{4}$ d.
 (13) 322916. (14) A $\frac{34}{843}$, B $\frac{343}{1122}$, C 36976.

EXERCISE CCXXXIII.

- (1) ·2; ·7. (2) $\frac{2}{80}$; $\frac{12}{105}$. (3) $\frac{1327}{13367}$.
 (4) $\frac{25}{32}$. (5) 3145815; 50000. (6) 2 $\frac{2}{3}$ days.
 (7) £59 0s. 2 $\frac{1}{4}$ d. (8) (9) 17s. 3 $\frac{2}{3}$ d.
 (10) £517 16s. 6d. (11) £180 19s. 9d. (12) 8 ft. 1 $\frac{3}{4}$ $\frac{4}{5}$ in.
 (13) 1536 $\frac{8}{13}$. (14) 4 $\frac{1}{2}$ lbs. (15) £34503 9s. 4 $\frac{1}{2}$ d.
 (16) £5 4s. 0 $\frac{3}{8}$ d. (17) 7 $\frac{2}{3}$ yards. (18) £27 10s.

EXERCISE CCXXXIV.

- (1) 11346127 $\frac{1}{3}$. (2) £450. (3) 999999 farthings.
 (4) 2 poles. (5) 18 shillings, 15 pence. (6) £1 5s. 5 $\frac{3}{8}$ d.
 (7) 12 $\frac{1}{2}$ months. (8) £515 10s. 5 $\frac{1}{2}$ d. (9) £825; £450.
 (10) 56 $\frac{2}{3}$ gain. (11) £7000. (12) 49 $\frac{1}{2}$; 1345 $\frac{1}{2}$.

EXERCISE CCXXXV.

- (1) $\frac{1}{12}$. (2) £6187 10s. (3) ·2.
 (4) £257 2s. 7875d. (5) 4999 + (6) 15872·5.
 (7) £55 15s. 7 $\frac{1}{2}$ d. (8) £2666 13s. 4d.

EXERCISE CCXXXVI.

- (1) £5. (2) £2 4s. 4 $\frac{1}{2}$ d. (3) 1.
 (4) £2. (5) 6 tons 11 cwts. 3 qrs. 7 lbs.
 (6) 25. (7) £85 70·07d. (8) £59070 13s. 8 $\frac{1}{2}$ d.
 (9) 1771.

EXERCISE CCXXXVII.

- (1) 97079. (2) £507 17s. 0 $\frac{1}{4}$ d. (3) 1·357; 531.
 (4) 358·4524. (5) £10·033. (6) £5 7s. 3 $\frac{1}{4}$ d.
 (7) £19. (8) £3 14s. 1 $\frac{1}{2}$ d. + $\frac{7}{125}$. (9) £815 3s. 9 $\frac{1}{4}$ d.
 (10) 17s. 6d. (11) £11 17s. 5d.

EXERCISE CCXXXVIII.

- | | | |
|---------------------------------|----------------------------------|----------------------------------|
| (1) $2\frac{1}{3}$. | (2) £1 1s. $1\frac{1}{4}$ d. | (3) $\frac{1}{2}$. |
| (4) 975·975975. | (5) ·84468. | (6) 19·91 - $19\frac{91}{100}$. |
| (7) Pig £5, cow £15, horse £80. | (8) £4698 7s. 6d. | |
| (9) 1 day. | (10) £134 16s. $2\frac{1}{4}$ d. | (11) £30 12s. $2\frac{3}{8}$ d. |
| | (12) 36 men. | |

EXERCISE CCXXXIX.

- | | | |
|---|--|---------|
| (1) $4\frac{3}{8}$. | (2) $1\frac{3}{4}\frac{1}{10}$. | (3) 22. |
| (4) $3\frac{1}{2}$ per cent. per annum. | (5) £39 0s. $5\frac{3}{4}\frac{1}{2}$ d. | |
| (6) £38 10s. 5d. | (7) 379 francs 50 centimes. | |
| (8) 29 francs 40 centimes. | (9) 121 grammes. | |
| | (10) $5\frac{1}{16}$ days. | |

EXERCISE CCXL.

- | | | |
|----------------------------------|--------------------------------------|------------|
| (1) 90778. | (2) 2753. | (3) 3·875. |
| (5) £282096 8s. 2d. | (6) £25 16s. $2\frac{1}{4}$ d. | |
| (7) £1661 14s. $0\frac{1}{2}$ d. | (8) 4s. $0\frac{3}{4}\frac{1}{2}$ d. | |

EXERCISE CCXLI.

- | | | |
|---|---|-----------------------|
| (1) $9\frac{1}{2}$. | (2) $4\frac{1}{2}\frac{5}{8}$. | (3) ·012. |
| (4) £33. | (5) £4 8s. $9\frac{1}{2}\frac{3}{4}$ d. | (6) $12\frac{1}{2}$. |
| (7) £52 2s. $2\frac{1}{4}$ d.; £116 9s. $3\frac{3}{4}$ d. | (8) £14 10s. $11\frac{1}{4}$ d. | |
| (9) $87\frac{1}{2}$; $83\frac{1}{2}$. | (10) 1447 feet. | (11) 504. |
| (12) £101 9s. 8·28258d. Simple interest £98. | | |

EXERCISE CCXLII.

- | | |
|---|---------------------|
| (1) £226 4s. $9\frac{3}{10}$ d. | (2) 72 square feet. |
| (3) $5\frac{1}{3}\frac{2}{3}\frac{1}{8}$ inches; £103 12s. $7\frac{5}{8}\frac{1}{4}$ d. | (4) 169·95. |
| (5) $25\frac{3}{8}$ francs for £1. | (6) 2·71828. |
| (7) £1476; £10 1s. $5\frac{1}{2}$ d. (8) 1000 original number, 2000 sent back. | |

EXERCISE CCXLIII.

(1) Two hundred and thirty millions, forty-six thousands, two hundred and fourteen.

- (2) 300,012,050. (3) 79,000,122. (4) 1,976,980,833.
 (5) £164572 12s. 10d. (6) £75790 17s. 9½d. (7) 17,056,283,825.
 (8) £48287 3s. 2d. (9) £25473 2s. 4½d. (10) £3831 12s. 3½d.
 (11) 69 tons 7 cwts. 2 qrs. 8 lbs. 15 oz. (12) 120.
 (13) £192 17s. 6¾d. (14) £6191 5s. (15) 24000.

EXERCISE CCXLIV.

- (1) £221 18s. 6½d. (2) a. 7¼½; b. ·17, ·057, ·7, ·591, ·5910, 1½, 1½, 7½, 1½½; c. 5·7692. (3) 1s. 5¼½d.
 (4) £553 5s. 2d. (5) £1 17s. 6d.; £1 10s.; £1 2s. 6d.
 (6) £1695 16s. 8d. (7) 10 per cent. (8) 893¼½. (9) 84¾.

EXERCISE CCXLV.

- (1) £5¼. (2) 7¾. (3) 6¾. (4) 1¼.
 (5) 1½. (6) 537·366. (7) 173 yds. 8·4375 ft. (8) ·192951.
 (9) 3074. (10) ·0234. (11) ·i. (12) 1·06; 2·263 +
 (13) a. £181 6s. 8d.; b. £90 13s. 4d. c. £45 6s. 8d.; d. £22 13s. 4d.
 (14) £1137 10s. (15) £428.

EXERCISE CCXLVI.

- (1) 8s. 4d. (2) 7 miles 2 fur. 1 pl. 4 yds. 1 ft. 6 in.
 (3) 1 lb. 3 oz. 7 dwt. 8¼½ grs.; 1498¾½ grs.
 (4) 23¼½ degrees; £1 14s. 0½d.; ·06515625. (5) 273·649.
 (6) 37·014000667307. (7) 26¼ lbs. (8) 105½ days.
 (9) £1 18s. (10) £11 5s. (11) £3 4s. 11d.
 (12) £1 15s. 7¼½d.

EXERCISE CCXLVII.

- (1) £6928 1s. 5½d. (2) £3070 12s. 8¼d.
 (3) £28 14s. 0¾d.; £13 18s. 10d.
 (4) 14 cwts. 2 qrs. 18¾ lbs.; 3 cwts. 12¾ lbs.; 2 cwts. 24¾ lbs.
 (5) £25 15s. 4¾d. (6) 43665; 968125.

EXERCISE CCXLVIII.

- (1) 1 ton 14 cwt. 2 qrs. 11 lbs. 25 oz.
14767441860465116279069.
- (2) £56 16s. $3\frac{2}{3}$ d. (3) £1024 Os. $4\frac{1}{2}$ d.
(4) £118 2s. (5) 17s. 8-79d. (6) £23 $\frac{1}{2}$ d.

EXERCISE CCXLIX.

- (1) One hundred and twenty-three millions, five hundred and forty-three thousand, eight hundred and seventy-six.
- (2) 400,120,301. (3) 63,000,122. (4) 120072506.
- (5) £177885 19s. 2d. (6) £339922 15s. $3\frac{1}{2}$ d.
- (7) 18279172892. (8) £12350 Os. $16\frac{1}{2}$ d.
- (9) £12345 6s. $7\frac{1}{2}$ d. (10) £4942 5s. $7\frac{1}{2}$ d.
- (11) 96 tons 9 cwt. 0 qrs. 4 lbs. 10 oz. (12) 91 lbs. 8 ozs.
- (13) £5378 9s. $10\frac{1}{2}$ d. (14) £1181 5s. 0d.
- (15) 60 shillings. (16) 13 per cent. (17) $7\frac{1}{8}$.
- (18) $4\frac{3}{8}$. (19) $2\frac{1}{11}$. (20) $\frac{1}{13}$.
- (21) 1052·202. (22) 4 pls. 7 yds. 2 ft. 48·96 in.
- (23) ·36579312. (24) 1·612. (25) 11·35.
- (26) ·1587301. (27) 9009. (28) 3s. 3d.
- (29) £124 9s. 2d.; £93 6s. $10\frac{1}{2}$ d.; £74 13s. 6d.; £62 4s. 7d.
- (30) £6 17s. 6d.

EXERCISE CCL.

- (1) $18\frac{4}{11}$. (2) $4\frac{9}{17}$. (3) 4281·55.
- (4) Gain 2s. 3d. per gal. (5) 600 gals.
- (6) £1240. (7) £71 $\frac{7}{23}$. (8) £564 3s. $0\frac{3}{8}$ d.

EXERCISE CCLI.

- (1) 4·12310562. (2) 42444. (3) 28 ft. $33\frac{3}{4}\frac{1}{4}$ in.
- (4) Loses £36. (5) $3\frac{1}{16}\frac{3}{4}$ ft.; 40 t. 17 c. 18 lbs. 3640 grs.
- (6) 17430 $\frac{7}{15}$. (7) 3·6142857. (8) $14\frac{4}{5}$.
- (9) 415 lbs. (10) $\frac{819}{8878}$. (11) $10\frac{1}{14}$.
- (12) $1\frac{1}{2}$ months. (13) £4836 13s. 4d. (14) 95·135895.

EXERCISE CCLII.

- (1) $\cdot 01849$; $\cdot 6299$. (2) 360360. (3) $20\frac{1}{2}$.
 (4) 1250. (5) $-31\frac{3}{4}$; $\frac{1}{2}$. (6) £600.
 (7) £12. (8) $6\frac{8}{45}$.
 (9) A, £25 5s. 9d.; B, £30 14s. 3d.
 (10) 73 c. yds. 8 c. ft. 98 c. in. (11) $11\frac{2}{3}$ days.
 (12) 124 fathoms.
 (13) A, $1266\frac{2}{3}$; B, $1066\frac{2}{3}$; A passes the corner three times, B twice.
 (14) 432. (15) A $17090\frac{1}{3}$; B $11393\frac{1}{3}$.

EXERCISE CCLIII.

- (1) $3\frac{1}{2}$. (2) 98 men. (3) 10 hrs. 52 min. 48 sec.
 (4) 16 hrs. (5) 1061; $393\frac{5}{8}$.
 (6) Length $10\frac{1}{2}$ yds., width $3\frac{1}{2}$ yds., height 4 yds. (7) $\frac{1}{4}$.
 (8) A, £501 16s. 6d.; B, £250 18s. 3d.; C, £83 12s. 9d.; D, £20 18s. $2\frac{1}{2}$ d.
 (9) £2350. (10) Gain, £1 17s. 6d. (11) $2037\frac{1}{4}$.
 (12) $275112\frac{1}{2}$ sq. links. (13) 4 inches. (14) 7.02 ft.
 (15) £70.

EXERCISE CCLIV.

- (1) $\frac{122102200}{12252240} \frac{14594520}{12252240} \frac{3573570}{12252240} \frac{7351344}{12252240} \frac{2144142}{12252240}$
 $\frac{2873216}{12252240} \frac{5105100}{12252240} \frac{4324320}{12252240} \frac{4813380}{12252240} \frac{4417875}{12252240}$
 (2) 14s. $3\frac{3}{4}$ d. (3) £21 10s. $7\frac{1}{2}$ d. (4) $\frac{28}{187}$.
 (5) 9s. $1\frac{8}{30}$ d. (6) $3\frac{1}{2}$. (7) $2\frac{3}{4}$.
 (8) $1\frac{1}{3}$. (9) 8. (10) $1\frac{2}{3}$ s.
 (11) 26057. (12) 235.104. (13) $\cdot 000156$.
 (14) $\cdot 002928$. (15) Nineteen millionth.

EXERCISE CCLV.

- (1) £1 0s. $6\frac{1}{2}$. (2) $\cdot 00336$. (3) $\cdot 54140625$.
 (4) 4.375. (5) $\frac{4}{18}$. (6) $\frac{1}{280}$.
 (7) 198; 81. (8) $96\frac{2}{3}$. (9) 1200.
 (10) 5 lbs.

EXERCISE CCLVI.

- | | | |
|--------------------------------|-------------------------------|---|
| (1) £284 6s. $1\frac{1}{2}$ d. | (2) £1196 19s. 6d. | (3) $9\frac{1}{2}$ d. |
| (4) 10 years. | (5) £720. | (6) 10s. $0\frac{1}{2}$ d. ; 75 per cent. |
| (7) 3s. $4\frac{1}{2}$ d. | (8) 9·93 gain. | (9) $12\frac{1}{2}$ per cent. |
| (10) 61s. $1\frac{1}{2}$ d. | (11) $5\frac{7}{15}$ gallons. | |

EXERCISE CCLVII.

- | | | |
|--------------------------------|---|----------------------|
| (1) 180829 oz. | (2) £9 4s. $10\frac{1}{2}$ d. | (3) £30613 5s. 6d. |
| (4) 109 15s. $6\frac{3}{4}$ d. | (5) $4\frac{17}{88}$. | (6) $2\frac{1}{8}$. |
| (7) 127. | (8) $7\frac{7}{8}$. | (9) 439·8067. |
| (10) 7·37966. | (11) 680·33892. | (12) 6·5451. |
| (13) 6s. $8\frac{1}{4}$ d. | (14) 512 mls. 4 fur. 183 yds. 2 ft. 9 in. | |
| (15) 2s. 1d. | (16) £36 10s. $2\frac{1}{4}$ d. | (17) £491 5s. 10d. |
| (18) $6\frac{3}{4}$. | (19) $5\frac{1}{2}$. | (20) $\frac{1}{4}$. |
| (21) $12\frac{3}{8}$. | (22) 44·34924. | (23) 61·90348. |
| (24) ·0488976. | (25) ·0014. | (26) 1·91163194. |

EXERCISE CCLVIII.

- | | | |
|---------------------------|------------------------|--------------------------------|
| (1) 62857296. | (2) 1320 years. | (3) £34 10s. $7\frac{1}{2}$ d. |
| (4) $3\frac{1}{2}$ years. | (5) $15\frac{5}{8}$. | (6) $1\frac{1}{8}$. |
| (7) $\frac{22}{115}$. | (8) $\frac{33}{127}$. | (9) 375·115. |
| (10) 84·2307. | (11) 43·0782. | (12) ·04375. |
| | (13) ·5972. | |

EXERCISE CCLIX.

- | | | |
|-----------------------------|--------------------------------|-------------------------------|
| (1) £588 11s. 11d. | (2) ·031 ; ·108. | (3) $16\frac{1}{2}$ per cent. |
| (4) $6\frac{1}{8}$ d. | (5) £3 2s. $0\frac{3}{4}$ d. | (6) 3795. |
| (7) £1449. | (8) £113 4s. $7\frac{1}{2}$ d. | (9) 4-horse. |
| (10) 1s. $10\frac{1}{2}$ d. | (11) $81\frac{1}{2}$ days. | |

EXERCISE CCLX.

- | | | |
|--------------------------------|------------------|-----------------|
| (1) 62573 ; $2\frac{10}{33}$. | (2) £993 4s. 6d. | (3) ·098101265. |
| (4) ·0020833. | (5) ·02916. | (6) ·015625. |
| (7) ·00274. | (8) ·12916. | (9) ·135. |
| (10) ·1833. | (11) ·00625. | (12) ·40625. |
| | (13) ·1875. | |

EXERCISE CCLXI.

- | | | |
|-----------------------------|-----------------------------|-----------------------------|
| (1) 1.25. | (2) 2.168. | (3) 15s. 6 $\frac{3}{4}$ d. |
| (4) 3s. 9d. | (5) 1 $\frac{1}{2}$ d. | (6) 3 bush. 1 pk. |
| (7) 6 $\frac{1}{2}$ inches. | (8) £7. | (9) £2 11s. 8d. |
| (10) £100. | (11) 1161 $\frac{9}{32}$ l. | (12) £27 7s. 9d. |
| | (13) 46.86 per cent. | |

EXERCISE CCLXII.

- | | | |
|--|-------------------------|----------------------------------|
| (1) 14 $\frac{1}{16}$. | (2) 4 $\frac{17}{32}$. | (3) 2790 $\frac{1}{4}$ l. |
| (4) 41 $\frac{333}{888}$. | (5) 1 $\frac{1}{2}$. | (6) 1 $\frac{1}{2}$. |
| (7) 34.62056. | (8) 41203. | (9) 74.151. |
| (10) 49000. | (11) .03. | (12) £9 19s. 6 $\frac{1}{4}$ d. |
| (13) 18 cubic feet, 1644 cubic inches. | (14) 13s. 9d. | |
| (15) 1512 francs. | (16) £13333 6s. 8d. | (17) £54 3s. 7 $\frac{3}{32}$ d. |
| (18) £32 8s. 11.52d. | (19) £9973 6s. 8d. | |

EXERCISE CCLXIII.

- | | | |
|------------------------------|-----------------------------------|-----------------------------------|
| (1) 1 $\frac{7}{11}$ l. | (2) 23 $\frac{1}{11}$ l. | (3) 3181 ; 3183. |
| (4) 9 hrs. 28 min. 4.8 secs. | (5) £56 14s. 5 $\frac{1}{2}$ d. | |
| (6) 323 miles. | (7) 93 gals. 3 qrts. | (8) £880 16s. 11 $\frac{1}{2}$ d. |
| (9) £34 13s. | (10) 52 gals. | (11) 70 $\frac{1}{2}$; 660. |
| | (12) £422 17s. 8 $\frac{3}{4}$ d. | |

EXERCISE CCLXIV.

- | | | |
|----------------|-----------------------------------|---|
| (1) 99999933. | (2) 7777. | (3) 1s. 4 $\frac{5}{16}$ d. |
| (4) £25 4s. | (5) 3s. 2 $\frac{1}{4}$ d. | (6) £4 15s. 9 $\frac{1}{4}$ d. ; 0046875. |
| (7) 108 miles. | (8) 13s. 4d. ; 5 yds. 0 ft. 9 in. | |

EXERCISE CCLXV.

- | | | |
|--------------------|----------------|-------------------|
| (1) .00005 ; 1500. | (2) £7 7s. 7d. | (3) £445 5s. 10d. |
| (4) £11 4s. | (5) 81. | (6) .2685546875. |

EXERCISE CCLXVI.

- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| (1) 1. | (2) 121 ; 13728. | (3) .0763 ; .3125. |
| (4) £1 0s. 8 $\frac{3}{8}$ d. | (5) 1234 ; 3 $\frac{1}{11}$. | (6) $\frac{38889}{1000}$ sec. |
| (7) £83 6s. 8d. | (8) £21 7s. 6d. | (9) No difference. |

EXERCISE CCLXVII.

- (1) 796123 $1\frac{1}{2}$ s. (2) 1d. (3) £1100 11s. 9 $\frac{1}{2}$ d.
 (4) $1\frac{3}{4}$; 10 $\frac{1}{4}$ d. (5) £1439 18s. (6) 501000; ·00501; ·05.
 (7) 66 days. (8) 10s. (9) £21 11s. 11 $\frac{1}{8}$ d.; £84 17s. 8 $\frac{1}{8}$ d.
 (10) 2047 c. ft. 1572 c. in. (11) Loses £5.

EXERCISE CCLXVIII.

- (1) 14973500. (2) 7402; 67 remainder.
 (3) Total weight, 10 tons 5 cwts.; average, 1 ton 0 cwt. 2 qrs.
 (4) £1209. (5) $\frac{1}{4}$; 2; 3 $\frac{1}{6}$.
 (6) B must give A 17s. 11d. (7) 1·5; 15000; 15.
 (8) ·2397916 ozs.; ·2398. (9) £126 13s. 7d.
 (10) £12 18s. 9d. true discount. (11) 5 months.
 (12) £1 5s. 3 $\frac{1}{2}$ d. (13) 1460.

EXERCISE CCLXIX.

- (1) 45808416423. (2) £723 5s. 4 $\frac{1}{2}$ d. (3) 12 miles.
 (4) 2 $\frac{3}{4}$. (5) 36250. (6) ·01775.
 (7) 25 per cent. (8) 2·2007 lbs. (9) £650.
 (10) £828 16s. 10 $\frac{1}{2}$ d. (11) £176 17s. 9·36d. (12) £2890 13s.

EXERCISE CCLXX.

- (1) 399; 65520. (2) $11\frac{1}{2}$; £4 7s. 2 $\frac{1}{2}$ d.
 (3) ·38048; 156250; 0004235. (4) £23 16s. 8d.; £71 4s. 6d.
 (5) Breadth, 123·45 ft.; length, 246·9 ft. (6) 34 $\frac{1}{2}$ c. in.

EXERCISE CCLXXI.

- (1) 66. (2) ·017073.
 (3) 11 $\frac{1}{11}$. (5) ·29371; 3·42857, 8·76491.

EXERCISE CCLXXII.

- (1) £536 15s. 10d. (2) 8s. 4d.
 (3) $1\frac{1}{7}$; 3 $\frac{1}{3}$. (4) ·064; ·06640625; ·06930.
 (5) 1116; $\frac{2}{3}$. (6) 14 $\frac{2}{7}$ minutes.

EXERCISE CCLXXIII.

- (1) £3 9s. $1\frac{1}{2}$ d. (2) 1s. $5\frac{1}{2}$ d.; 4s. $11\frac{1}{4}$ d.
 (3) $\frac{2}{3}$; $326\frac{11}{10}\frac{7}{4}$. (4) 10 years.
 (5) 43·803; 6·928.

EXERCISE CCLXXIV.

- (1) 2260; $\frac{1}{7}$; 1. (2) 4·320625. (3) $6\frac{543}{1481}$.
 (4) £97 5s. $11\frac{1}{3}\frac{1}{2}$ d; £118 18s. $4\frac{1}{3}\frac{1}{2}$ d. (5) 6; 5·6692.

EXERCISE CCLXXV.

- (1) ·9525: 33 sec. (2) £12 1s. 6d.; £8 1s.; £6 0s. 9d.
 (3) 4·1231. (4) 3 fur. 23 pls. 2 yds. 0 ft. 3 in.
 (5) $24\frac{7}{8}$ yds. by $16\frac{7}{8}$ yds.

EXERCISE CCLXXVI.

- (1) £76 14s. 7d. (2) £165 12s.
 (3) 1240; ·000484375. (4) £117.
 (5) 620·1; ·5505.

EXERCISE CCLXXVII.

- (1) 1; $8\frac{2}{3}\frac{2}{5}$. (2) $7\frac{5}{8}\frac{5}{8}$.
 (3) ·021484375; ·106; 1·0742640620; 30000.
 (4) $666\frac{3}{5}$ quarters. (5) 7·872.

EXERCISE CCLXXVIII.

- (1) $\frac{111}{421}$; $528\frac{504}{3980}\frac{330}{4455}$.
 (2) $12\frac{539}{1830}$; ·00152587890625; 6553·6.
 (3) $\frac{1}{3216}$. (5) $\frac{11691}{85533}$.

EXERCISE CCLXXIX.

- (1) £74 11s. (2) $\frac{1357}{8887}$. (3) $21\frac{591}{1054}$ sec.
 (4) 77494. (5) A £106 $\frac{1}{4}$; B £79 $\frac{3}{4}$; C £169 $\frac{1}{4}$.
 (6) 10·26 lbs.

EXERCISE CCLXXX.

- (1) 22. (2) a. £22220 19s. $4\frac{1}{2}$ d.
 b. £14 6s. $1\frac{1}{2}$ d.
 (3) £1204 13s. 9d. (4) $13\frac{2}{125}$; $4\frac{19}{180}$.
 (5) $7\frac{1}{2}$; $1\frac{1887}{1000}$. (6) 2·0272.
 (7) 24·508. (8) 23 tons 18 cwts. 2 qrs. 8 lbs. (9) 904 tons.

EXERCISE CCLXXXI.

- (1) a. Four hundred and five millions, six hundred and seventy-two thousand, and thirty.
 b. Sixteen billions, one hundred and forty-two thousand, eight hundred and fifty.
 c. Eight millions, two hundred and eighty thousands, nine hundred.
 (2) 84870834 $\frac{575}{1075}$. (3) £2064 9s. 3d.; £171 10s. $2\frac{1}{4}$ d.
 (4) 4 drs. 0 scr. $2\frac{7}{12}$ grs. (5) $1\frac{88}{100}$; $3\frac{3}{4}$. (6) $3\frac{187}{100}$.
 (7) £25 7s. $1\frac{1}{2}$ d.; 024959, etc. (8) 1000000000.

EXERCISE CCLXXXII.

- (1) £516 4s. $3\frac{1}{2}$ d. (2) £158 12s. $8\frac{1}{2}$ d.
 (3) 5 tons 12 cwts. 1 qr. 14 lbs. (4) 109. (5) 57.
 (6) $\frac{2}{3}$. (7) 7 oz. 4 drs. 0 scr. $13\frac{1}{2}$ grs.
 (8) 08; $\frac{2}{25}$. (9) $\frac{7}{40}$. (10) $\frac{743}{1475}$.

EXERCISE CCLXXXIII.

- (1) Twenty-five thousand, six hundred and seventy-eight; two hundred thousand and one; three millions, forty thousand, five hundred and six; 2760675.
 (2) 7d.; £14 11s. 8d. (3) 968784 in.
 (4) 1 lb. 2 oz. 7 drs. 0 scr. 15 grs.; 3 lbs. 3 oz. 6 drs.; 70 lbs. 4 oz. 5 drs. 1 scr. 10 qrs.; $\frac{1}{125}$ T. (6) $9\frac{147}{1000}$.
 (7) 4s.; $4\frac{1}{2}$ d.; $\frac{1}{2}$ d.; $\frac{1}{125}$ d.; $\frac{111}{1000}$.
 (8) £900 15s. 1d.; £1801 10s. 2d.; £2702 5s. 3d.
 (9) £14 010s.; £2 $14\frac{1}{10}$ s.

EXERCISE CCLXXXIV.

- (1) £165 0s. 10d. (2) £2722 10s. (3) 3780; $\frac{47}{11}$.
 (4) $\frac{3}{4}$. (5) £1 10 $\frac{3}{4}$ s.; 10s. 10 $\frac{1}{2}$ d.
 (6) £6 16s. 6d. (7) 1 oz. 13 dwts. 14 $\frac{1}{2}$ grs.
 (8) 17s. 9 $\frac{1}{2}$ d. (9) $\frac{48}{11}$; 2100; .0075. (10) 1618·64.
 (11) £75 6s. 3d.; £225 18s. 9d.; £376 11s. 3d.; £527 3s. 9d.

EXERCISE CCLXXXV.

- (1) £9 1s. (2) 14 wks. 2 days. (3) 4s.
 (4) £6 8s. 3 $\frac{1}{2}$ d. (5) 11. (6) 4·025.
 (7) 25·886375; 1015·15196, etc.
 (8) $\frac{8}{11}$; ·795031055900621118.
 (9) 12, 24, 36, 48; 28 $\frac{1}{2}$, 38 $\frac{3}{8}$, 57 $\frac{3}{8}$, 115 $\frac{1}{2}$. (10) 25 $\frac{245}{147\frac{1}{2}}$.

EXERCISE CCLXXXVI.

- (1) 67958028. (2) £383 16s. 11d. (3) £85876 10s. 2 $\frac{1}{2}$ d.
 (4) 7. (5) $\frac{1}{5}$; 32 $\frac{1}{10}$. (6) 6 $\frac{3}{8}$ cwts.
 (7) £2732 5s. 10d. (8) $\frac{1}{5}$; ·03
 (9) 4s. 6d.; £1 19s. 4d.; 30·7; 143750.
 (10) 18·35 per cent. of nitrogen, 56·056 of carbon.

EXERCISE CCLXXXVII.

- (1) 758061120. (2) £4987 1s. 8 $\frac{1}{2}$ d.; 21 lbs. 8 oz. 6 drs. 4 grs.
 (3) 63. (4) 22440. (5) £5 17s. 4d.
 (6) 3 $\frac{1}{8}$. (7) $\frac{1}{8}$. (8) ·263157894736842105; ·12.
 (9) ·1779861. (10) 11s. 3 $\frac{1}{2}$ d.

EXERCISE CCLXXXVIII.

- (1) 1992648. (2) 25 lbs. 1 oz. 2 dwts. 8 grs.; £16195 1s.
 (3) 27 lbs. 8 oz.; £6 18s. 8 $\frac{1}{2}$ d. (4) 13 mls. 1127 yds. 1 ft. 11 in.
 (5) 26 $\frac{7}{10}$; 36 $\frac{19}{10}$. (6) 2·0128; 1 $\frac{3}{8}$ $\frac{3}{10}$.
 (7) ·1480. (8) $1\frac{3}{8} \times 2\frac{5}{8}$ is greatest by 3·9862.
 (9) 39 $\frac{19}{100}$ cu. ft. (10) 3 $\frac{3}{4}$ miles per hour.

EXERCISE CCLXXXIX.

- (1) 100 a. 2 rds. 37 pls. $28\frac{3}{4}$ yds. (2) 1 dr. $12\frac{7}{8}$ grs.
 (3) 261 hhds. $6\frac{2}{3}$ gals. (4) £12 11s. $10\frac{1}{2}$ d.
 (5) $15\frac{1}{6}$, $21\frac{1}{2}$, $61\frac{1}{6}$.
 (6) £1 9s. 9d.; £4660 17s. $9\frac{1}{2}$ d.; $\frac{41}{180}$. (7) $\cdot 05$; $\frac{1857141}{200000000}$.
 (8) $12\frac{1}{2}$.

EXERCISE CCXC.

- (1) 33 years. (2) $\frac{1}{2}$; $6\frac{1}{2}$.
 (3) $\cdot 875$; $3\cdot 056$; $\cdot 015625$; $3\frac{1}{8}$; $3\cdot 946625$. (4) $\cdot 06539808$; $40\cdot 8$.
 (5) $\cdot 14921875$; 7 dwts. 9 grs. (6) £220 9s. $5\frac{1}{4}$ d.; £11 18s. $5\frac{1}{4}$ d.
 (7) $11\frac{1}{2}$; $1\frac{1}{2}$ oz. (8) $\frac{7}{391}$ oz.; $\frac{2}{31}$ oz.; $1\frac{2}{85}$.

EXERCISE CCXCI.

- (1) Seven hundred millions, three hundred and twenty-five thousand, eight hundred and ninety-six; 606000096.
 (2) £7 18s. 2d., £11 17s. 3d.; $\frac{2}{7}$. (3) $\frac{2}{21}$. (4) $\frac{1}{80}$.
 (5) $\cdot 35665$; $29219\cdot 84$. (6) $\cdot 8$; $\frac{811}{1080}$.
 (7) £553 11s. 6d. (8) £34 6s. 11d.

EXERCISE CCXCII.

- (1) Four hundred and fifty billions, nine hundred and fifteen millions, four hundred and fifty thousand, nine hundred and fifteen.
 (2) £18195 19s. $11\frac{1}{2}$ d.; 4d. to poor box.
 (4) $\frac{1}{15}$. (5) $1\frac{1}{2}$. (6) 102·390561.
 (7) $\cdot 03625$; $\cdot 00091517857142$. (8) 157; 79.

EXERCISE CCXCIII.

- (1) £27 10s. $11\frac{1}{2}$ d. (2) 217. (3) £22 8s. 4d.
 (4) $\cdot 55546875$; $\frac{1}{8}$. (5) $\cdot 0625$; $\frac{1}{80}$; $\frac{1}{20}$. (6) $\cdot 0417$; $\frac{1}{18880}$.
 (7) 2s. $3\frac{1}{2}$ d. (8) 60. (9) £3 15s. $7\frac{1}{2}$ d. (10) £140.

EXERCISE CCXCIV.

- (1) 547. (2) 3936. (3) 7s. 6d.
 (4) £25 14s. 4½d. (5) £209 8s. 6d. (6) 3s. 1½d.
 (7) 42. (8) 9709 bus. 1½ pks. (9) 20 miles per hour.
 (10) 10 years.

EXERCISE CCXCV.

- (1) 5 ft. 10½ ins. (2) £147 9s. 11¾d.; £132 13s. 2¾d.
 (3) £22 19s. 4½d. (4) ¾ of 2½, greatest 1½, ¾; 2½; 4¾ least.
 (5) 13¾; 9¾. (6) £160.
 (7) 18243; £2 7s. 9d.; £2 8s. 5½d. (8) 14°02'78"; 12°1.
 (9) 347; 2¾. (10) £247 9s. 4¾¾¾d.
 (11) A £1900, B £1500, C £1200; A £142 10s., B £112 10s., C £90.
 (12) 11 hrs. 36 min. 23¾ sec. or gains 23 min. 36¾ sec.

EXERCISE CCXCVI.

- (1) £119 11s. 7½d.; £58 19s. 1½d. (2) £42 15s. 10d.
 (3) 28 days. (4) £36 17s. 9¾d.
 (5) £352 5s. 8¾d.; £203 18s. 7d. (6) £633 16s. 6d.
 (7) ¾ greatest, 1½ least. (8) 1¾; 11¾.
 (9) £3 3s. 3¾d. (10) 128; £1 16s. 9d.
 (11) 17°3; 0°173. (12) 8 lbs.

EXERCISE CCXCVII.

- (1) 457530599592; 37090. (2) £18 16s. 8¾d.
 (3) 2 m. 7 furs. 1 yd. 1 ft. 6 in.
 (4) 69 lbs. 7 oz. 8 dwts. 21 grs.; 1 day 9 hrs. 18 min.
 (5) 10½; 1. (6) 300. (7) 12 hrs. (8) £4 15s. 7d.
 (9) £13 10s. 1¾d.

EXERCISE CCXCVIII.

- (1) 9165¾. (2) 1680. (3) 7¾ months.
 (4) 27888; 2388. (5) 21; 1800; 22100; 1221.
 (6) 29271. (7) 0076, 00048951, 000003084483.
 (8) 10s. 8¾d.; 1 qr. 23 lbs. 4 oz. 11¾ drs.; 7 furs. 31 pls.
 1 yd. 2 ft. 6 in.
 (9) 13509; ¾; 37½. (10) £1202 10s.; £39.

EXERCISE CCXCIX.

- (1) 2040315612843186 ; 34002426678 $\frac{22788}{100000}$. (2) 1795.
 (3) 2481. (4) 6s. 2 $\frac{334}{100}$ d. (5) 4333 $\frac{31}{100}$.
 (6) 12 $\frac{888}{100}$. (7) £9222 18s. 7 $\frac{1}{2}$ d.
 (8) £13 $\frac{2314992}{1127007}$ per cent. (9) 1274·49. (10) 14400.]

EXERCISE CCC.

- (1) 4300951820 ; 400750321 ; four hundred millions, seven hundred and fifty thousand, three hundred and twenty-one.
 (2) £259340 3s. 1 $\frac{1}{2}$ d. = 248966550 farthings. (3) 138 $\frac{333335888}{1111111111}$.
 (4) £528 19s. 10 $\frac{1}{2}$ d. (5) 3 $\frac{2787}{18387}$. (6) 610 $\frac{1}{2}$.
 (7) 12 $\frac{1}{2}$. (8) $\frac{90}{112}$; $\frac{1}{16}$. (9) 180.

EXERCISE CCCI.

- (1) £32 5s. 9 $\frac{3}{8}$ d. (2) $\frac{2}{3}$. (3) £1 1s.
 (4) £20. (5) ·08 ; 198·25 ; $\frac{6}{11}$.
 (6) £6 12s. 5 $\frac{1}{8}$ d. ; ·5. (7) 4 $\frac{1}{2}$ per cent. (8) £4 $\frac{1}{2}$.
 (9) £90. (10) 2·3. (11) 9 months.

EXERCISE CCCII.

- (1) 12483 a. 3 rds. 24 pls. ; 36 pls. 5 ft. (2) 2s. 8d.
 (3) 12 $\frac{3}{4}$. (4) £4 4s. ; £1 16s. 10 $\frac{1}{2}$ d. (5) 45 $\frac{3}{8}$.
 (6) 14 lbs. 6 oz. 13 dwts. 18 grs. (7) 4 $\frac{1}{2}$ years.
 (8) 19 $\frac{3}{1000}$; ·0704 ; 1760. (9) £12 17s. 3d. ; ·125.

EXERCISE CCCIII.

- (1) 2210789760 ; 780060 $\frac{8112}{111}$ grains. (2) 1580 grs. ; 17 $\frac{1}{2}$ gneas.
 (3) 5 furs. 10 pls. 3 $\frac{1}{4}$ yds. (4) £2255 2s. 4 $\frac{1}{2}$ d.
 (5) £9 7s. 2 $\frac{1}{2}$ d. (6) 40 $\frac{1}{3}$. (7) $\frac{1}{4}$. (8) $\frac{1}{16}$.
 (9) £10 10s. (10) 7s. 6d. (11) £162 13s. 3d.

EXERCISE CCCIV.

- (1) A 4 $\frac{2}{3}$ mls., B 5 $\frac{1}{3}$ mls. (2) 1 $\frac{31}{120}$; $\frac{11}{15}$; $\frac{50}{143}$.
 (3) 24·16 ; 3·085 $\frac{4}{11}$; 11·89 $\frac{4}{11}$. (4) 28·163862 kilometres.
 (5) £233 8s. 7 $\frac{811}{1843}$ d. ; 5s. 9 $\frac{122}{1843}$ d. (6) £24 12s. ; 3 $\frac{1}{11}$ per cent.
 (7) 221 and 325. (8) £5 19s. 3 $\frac{9}{10}$ d.
 (9) 180000 tons. (10) £74 $\frac{482}{111}$ per cent.

EXERCISE CCCV.

- (1) 5 yrs. 1 wk. 2 dys. 8 hrs. (2) $1\frac{8}{11}\frac{1}{2}$; 223. (3) 8s. $1\frac{1}{4}$ d.
 (4) .0082242; .0245. (5) £3 17s. $10\frac{1}{2}$ d.
 (6) £556 16s. $9\frac{1}{4}$ d.; £187 13s. $2\frac{1}{8}$ d. (7) $27\frac{2}{13}$ cwts.
 (8) 3 per cent. (9) £5003 5s. $1\frac{1}{4}$ d.
 (10) £93 17s. $3\frac{87}{119}$.

EXERCISE CCCVI.

- (1) Three millions, four hundred and seven thousand, and sixty-two;
 82045017.
 (2) 4236 a. 27 pls.; £2 18s. 1d. (3) 1616160.
 (4) $1\frac{3993}{3888}$; $\frac{1}{70}$. (5) $1\frac{243}{11840}$; £8 9s. $2\frac{1}{2}$ d.
 (6) £507 2s. $5\frac{1}{4}$ d.; £52 0s. 8d. (7) $4922\frac{1}{4}$ d.
 (8) 24 miles per hour; 1.55 P.M.

EXERCISE CCCVII.

- (1) .008 per cent. (2) £92031 19s. $2\frac{3}{4}$ d.
 (3) 18 yds. 3 in. (4) 7 months.
 (5) £8053 17s. 4d.; £11467 6s. $5\frac{1}{4}$ d. (6) $\frac{4}{5}$ per cent.
 (7) $2\frac{137}{3200}$; $3\frac{209}{3000} = 3.069\bar{6}$. (8) .0025.
 (9) $\frac{3}{4}$; £1 6s. 10d. man's share; £1 0 $1\frac{1}{2}$ d. boy's share.
 (10) 3.28.

EXERCISE CCCVIII.

- (1) £7 10s. 8d. (2) £61752 18s. $3\frac{1}{2}$ d.; £1909 2s. $11\frac{1}{2}$ d.
 (3) $175\frac{1}{2}$ (4) 6480 frs. for 51 centimes.
 (5) G. C. M. = 282; L. C. M. = 288. (6) $5\frac{91}{288}$; $8\frac{143}{16}$.
 (7) .03571057035; 780. (8) £102 18s. 4d.
 (9) £663 6s. 9d.

EXERCISE CCCIX.

- (1) £1159 8s. 3d. (2) 677 a. 1 rd. $25\frac{1}{4}$ pls. (3) 1019632.6.
 (4) £58148 9s. $0\frac{1}{4}$ d. (5) 147; £32 9s. $3\frac{1}{2}$ d. (6) 223.
 (7) £1 4s. 1d. (8) $130\frac{321}{88}$; £69 12s. 7d.
 (9) B £19 12s. $8\frac{1}{2}$ d.; A £87 12s. 1d.; $\frac{3}{4}\frac{1}{16}$.

EXERCISE CCCX.

- | | | |
|---|----------------------------------|--------------|
| (1) $\cdot 0\dot{2}3\dot{4}$; $002\dot{9}2\dot{7}$. | (2) $5\dot{1}\frac{4}{5}$. | (3) £167 2s. |
| (4) $\cdot 03014$. | (5) $\cdot 948$; $\cdot 0687$. | |
| (6) £2767 16s. $8\frac{1}{4}$ d. | (7) £6 3s. 3d.; 20 per cent. | |
| (8) 7·75 per cent. | (9) 24 years. | |
| (10) $5\frac{1}{2}$ per cent. | (11) £1000 stock. | |
| (12) £413 4s. $4\frac{2}{3}$ d.; £367 6s. $1\frac{1}{3}$ d.; £275 9s. $6\frac{1}{3}$ d. | | |

EXERCISE CCCXI.

- | | | |
|--|-------------------------------|--------------|
| (1) £1074 9s. $0\frac{1}{2}$ d. | (2) $2\frac{1}{3}$. | (3) £167 2s. |
| (4) $\cdot 375$; $3\frac{3}{8}$. | | |
| (5) a. 1200. b. $\cdot 0012$. c. 14·4. d. 10. e. $\cdot 0144$. f. $\cdot 01$. | | |
| (6) $\cdot 165625$. | (7) 12. | (8) £1000. |
| (9) £103 10s.; £102. | (10) £4 8s. $1\frac{1}{2}$ d. | |

EXERCISE CCCXII.

- (1) 156729 $\frac{1}{8}$.
- (2) Three millions, sixty thousand, five hundred and seventy-four; 4306227618.
- | | |
|--|-----------------------|
| (3) 5 tons 7 cwts. 1 qr. 8 lbs. 4 oz. | (4) £1 10s. 3d. |
| (5) £1033075 15s. 3d. | (6) 141036. |
| (7) 3 furs. 37 pls. 4 yds. 1 ft. 6 in. | (8) $2\frac{1}{10}$. |
| (9) £11071 6s. 9d. | (10) 33 men. |

EXERCISE CCCXIII.

- | | | |
|---------------------------|-------------------------------------|----------------------------|
| (1) 50·48 inches. | (2) $\cdot 25987326$. | (3) 9·84375; $\cdot 814$. |
| (4) $26\frac{1}{2}$ tons. | (5) $17\frac{9}{25}$ ft. | (6) £3715; £5. |
| (7) $10\frac{1}{4}$ | (8) A 6s. 4d.; B 8s. 2d.; C 5s. 2d. | |
| (9) £1262 10s. | (10) $\cdot 042784$. | |

EXERCISE CCCXIV.

- | | |
|--|---|
| (1) 4057. | (2) 4 cwts. 0 qrs. 21 lbs. $9\frac{1}{2}$ oz. |
| (3) $31\frac{1}{2}$; $5\frac{21}{41}$. | (4) 1·69375. |
| (6) $28\frac{1}{8}$. | (5) £2400 9s. $11\frac{1}{2}$ d. |
| (7) 10 hrs. 50 min. $10\frac{1}{11}$ sec. | |
| (8) £1 17s. $11\frac{1}{300}$ d.; £418 0s. $5\frac{1}{300}$ d. | |
| (9) A £750; B £400. | (10) £50. |

EXERCISE CCCXV.

- (1) MDCCXLIX; 1749.
 (2) 31 tons 16 cwt. 0 qr. 12 lbs.; 82 tons 3 cwt. 1 qr. 3 lbs.
 (3) £8 14s. 6 $\frac{1}{2}$ d. (4) £279 11s. 7 $\frac{1}{2}$ d.; £577 15s. 2d.
 (5) $\frac{7}{12}$; 33 $\frac{1}{3}$. (6) 4 poles.
 (7) £1493 1s. 1 $\frac{1}{2}$ d. (8) 3 $\frac{3}{4}$ miles.
 (9) £80 19s. 6d. (10) £15; 12 per cent.

EXERCISE CCCXVI.

- (1) 64230793694. (2) 131490. (3) 79 $\frac{5}{11}$.
 (4) £66 12s. 2d. (5) 238 16s. 7·02d. (6) £97 14s. 8 $\frac{7}{100}$.
 (8) 41 $\frac{987}{1000}$; 2 $\frac{22}{100}$; 1 $\frac{33}{100}$. (9) ·0416; £4 19s. 2·2464d.
 (10) ·001169845209; 21·30082. (11) 20 $\frac{1}{2}$ ft.
 (12) 1—5s. 3d.; 2—6s. 3d.; 3—7s. 3d.; 4—8s. 3d.; 5—9s. 3d.;
 6—10s. 3d.; 7—11s. 3d.; 8—12s. 3d.; 9—13s. 3d.

EXERCISE CCCXVII.

- (1) a. Two hundred and thirty-four millions, five hundred thousand, and seventy-two.
 b. Three billions, seven hundred and two millions, forty thousand, two hundred and thirty.
 c. Fifty millions, four hundred and sixty-five thousand, and seven.
 d. Two thousand and one.
 e. Three billions, nine hundred and eighty-seven millions, seven thousand, three hundred and ten.
 (2) 3 cwt. 1 qr. 2 lbs. (3) 503 $\frac{1}{2}$. (4) £11910 12s.
 (5) $\frac{1}{2}$; $\frac{1}{4}$. (6) 2 $\frac{2}{3}$; 1. (7) $\frac{1}{10}$; 19s. 2d.
 (8) ·0295554; £1 7s. (9) 200 sq. ft. 100 sq. in.
 (10) £425 5s. 4·46d.

EXERCISE CCCXVIII.

- (1) 94842645784 $\frac{2}{3}$. (2) £240 14s. 6 $\frac{1}{2}$ d. (3) 632834775.
 (4) 151092 ins. (5) £9 6s. 1d. (6) 31 $\frac{1}{3}$ $\frac{2}{3}$.
 (7) $\frac{40}{663}$; $\frac{2}{3}$. (8) 24. (9) 20.

EXERCISE CCCXIX.

- (1) £25 2s. $3\frac{1}{2}$ d.
 (2) 5544, 17; 5544, 19; G. C. M. 5544; L. C. M. 1750712; $\frac{1}{15}$.
 (3) $3214285\frac{7}{8}$. (4) $30\cdot50\frac{5}{8}$; $\cdot056875$. (5) 1 shilling.
 (6) $\cdot05$. (7) $29\cdot03$; $3\frac{2}{9}$. (8) £1660.
 (9) A £329; B £121. (10) £3600.

EXERCISE CCCXX.

- (1) 794997. (2) 2 furs. 28 pls. 4 yds. 0 ft. $1\frac{1}{2}$ in.
 (3) $22\frac{1}{2}$. (4) $1\frac{3}{8}$; $1\frac{1}{7}$. (5) $\frac{7}{10}$; £3 11s. $10\frac{1}{3}$ d.
 (6) 8053·6; $1\cdot\frac{3}{4}$. (7) £1 19s. $4\frac{1}{2}$ d. (8) £1199 13s. $4\frac{1}{2}$ d.
 (9) £370. (10) £22 $\frac{1}{2}$.

EXERCISE CCCXXI.

- (1) 3152612974035. (2) £7636 18s. $9\frac{1}{2}$ d.
 (3) £57 13s. $4\frac{1}{2}$ d.; 19s. $9\frac{2}{3}$ d. (4) 65 lbs. 7 oz. 16 dwts. 18 grs.
 (5) 1 cwt. 24 lbs. (6) 4 days.
 (7) £121 12s. $0\frac{1}{2}$ d. (8) $12\frac{1}{8}$.
 (9) $\frac{1}{8}$. (10) $\frac{7}{10}$.

EXERCISE CCCXXII.

- (1) £55 8s. $7\frac{1}{2}$ d. (2) $1\frac{1}{4}$; $\cdot077725$. (3) £5 12s. 6d.
 (4) $1\cdot3165$; $\cdot1732$. (5) $\cdot708\dot{3}$; $\cdot6791\dot{6}$; $119791\dot{6}$; £1 10s. $1\frac{1}{2}$ d.
 (6) £333 7s. 4·8d. (7) £54 19s. $71\frac{1}{8}\frac{3}{4}$ d. (8) £3750.
 (9) 19s. 6d. (10) $4\frac{1}{2}$ per cent.; £222 4s. $5\frac{1}{2}$ d.

EXERCISE CCCXXIII.

- (1) £1849 1s. $4\frac{1}{2}$ d. (2) $3\frac{1}{2}$.
 (3) 4s.; £1 11s. 3d.; £2 4s. $6\frac{3}{11}$ d. (4) $\cdot068$; $\cdot257142\dot{8}$.
 (5) One hundred and forty thousand, one hundred and eighty-four;
 one hundred millionth.
 (6) $\cdot875$; $\cdot6375$; $\cdot16875$; £1 13s. $7\frac{1}{2}$ d. (7) 1 lb. 5 oz.
 (8) £492 4s. $10\frac{1}{2}$ d. (9) £21 8s. 3d. (10) £55 11s. $3\frac{1}{2}$ d.

EXERCISE CCCXXIV.

- (1) One million, four hundred and one thousand, eight hundred and forty.
 (2) £428 1s. 8d. ; £1223 1s. 10½d. (3) 2 lbs. 3 oz.
 (4) $\frac{1}{4}$; $\frac{1}{8}$. (5) $5\frac{2}{5}$.
 (6) 11 lbs. 1 m. 3 furs. 0 pls. 1 yd.
 (7) 2 pls. 16 yds. 5 ft. 136 in. (8) £178 10s.
 (9) £30 13s. 4d. (10) 17 yds. 2 ft. 6½ ins.

EXERCISE CCCXXV.

- (1) Four hundred and fifty millions, seventy thousand and twenty-four.
 (2) £558308 19s. 0½d. (3) £78 4s. 11½d.
 (4) 14 days 1 hr. 4 mns. 19 secs. (5) £309 6s. 3d.
 (6) $\frac{63}{180}$; $\frac{23}{38}$. (7) Gains £5 10s. 6d.
 (8) £1682. (9) 100 lbs.

EXERCISE CCCXXVI.

- (1) 2 cwts. 3 qrs. 14 lbs. (2) £50 1s. 11d.
 (3) $\frac{44}{288}$; £1 8s. 5½d. (4) $2\frac{53}{100}$; 10185.
 (5) 20 years. (6) 1190476. (7) £9 7s. 6d.
 (8) 15 days. (9) 300 silver, 600 gold.

EXERCISE CCCXXVII.

- (1) 00694 ; 23046. (2) £1120.
 (3) 3590625 ; 8s. 6½. (4) $2\frac{7}{8}$. (5) 50008.
 (6) £793, £549, £305 ; 15½ per cent. (7) £600 11s. 5½d.
 (8) £3494 2s. 4¼d. ; £148 10s., £4455. (9) 1½ hours.
 (10) £3 18 12½d.

EXERCISE CCCXXVIII.

- (1) 1284 ; 216. (2) 6 tons 15 cwts. 2 qrs. 24 lbs.
 (3) 6036486. (4) 5967 a. 2 rds. 25 pls.
 (5) 38. (6) £11875. (7) $125\frac{134}{801}$.
 (8) $11776\frac{197}{214}$. (9) $7\frac{23}{8}$; £1 1s. (10) $\frac{7}{25}$; $\frac{7}{25}$, $\frac{1}{11}$.

EXERCISE CCCXXIX.

- (1) 4527. (2) £5 9s. 6d. (3) 366 $\frac{37}{2}$.
 (4) £25675 14s. 7 $\frac{1}{2}$ d. (5) 17 years. (6) $\frac{35}{44}$; 34; 420.
 (7) 13 $\frac{19}{20}$, 13·05; $\frac{532}{83} = 89\frac{83}{83}$. (8) $\frac{17}{100}$.
 (9) £749 3s. 4d.

EXERCISE CCCXXX.

- (1) 26. (2) £23077 1s. 3 $\frac{87}{112}$ d. (3) £248 18s. 11 $\frac{1}{4}$ d.
 (4) 25 $\frac{1}{6}$ days. (5) £21484 16s.; £24170 8s.
 (6) A £74 10s., B £77 10s., C £73 10s.; $\frac{148}{111}$; $\frac{148}{111}$; $\frac{148}{111}$.
 (7) 39 $\frac{19}{1000} = 39\cdot0355158730\bar{1}$. (8) 55·5; 2·12.
 (9) £7350 stock; £251 17s. 9 $\frac{1}{2}$ d.

EXERCISE CCCXXXI.

- (1) £7 6s. 11·015625. (2) 2 $\frac{1}{2}$. (3) $\frac{9}{220}$; ·040 $\dot{9}$.
 (4) ·20 $\dot{2}5\dot{9}$; ·0410. (5) ·28. (6) 196·773 nearly.
 (7) 26 $\frac{2}{3}$. (8) £2 12s. 6 $\frac{2}{3}$ d. (9) 5 : 4.
 (10) £15. (11) 8·01 feet; 20057·43 lbs.

EXERCISE CCCXXXII.

- (1) ·3. (2) £31 4s. 11 $\frac{28}{100}$ d.; 4s. 7d. (3) £27 10s. (4) £730 16s.
 (5) Sum 1 $\frac{32071}{24976}$, difference $\frac{11326}{24976}$, product $\frac{12721}{24976}$, quotient $\frac{23971}{24976}$.
 (6) £2354 6s. 3 $\frac{34}{100}$ d. (7) The former by ·0828.
 (8) 4 oz. 13 dwts. 17 $\frac{127}{100}$. (9) 93 $\frac{27}{100}$. (10) 3s. 3 $\frac{1}{2}$ d.
 (11) £181 10s. 1 $\frac{483}{1000}$. (12) £303 3s. 5 $\frac{77534}{100000}$ d.

EXERCISE CCCXXXIII.

- (1) 3s. 6d.; ·175. (2) £23542 10s.
 (3) C first, B 1 ft. behind, A 2 ft. behind. (4) 64 feet.

EXERCISE CCCXXXIV.

- (1) (2) 3s. 6d. (3) 263; 1·35.
 (4) 2040; 4; 40; ·04. (5) ·3; ·01525.
 (6) $113\frac{1}{2}$. (7) 20 men. (8) £71 4s. $0\frac{1}{4}$ d.
 (9) £137 10s. (10) £2 1s. 8d.

EXERCISE CCCXXXV.

- (2) £703 5s. $9\frac{1}{4}$ d. (3) $1\frac{1}{12}$; $\frac{8}{9}$.
 (4) 4652; ·4652; 35·5681. (5) 15 miles.
 (6) $\frac{5}{24}$, $\frac{7}{12}$, $\frac{77}{222}$; ·6328; ·826213. (7) 4·3588; 1·3784; 5·5726.
 (9) 2·20. (10) £18 18s. (11) £650. (12) £24000.

EXERCISE CCCXXXVI.

- (2) £458 7s. $11\frac{1}{2}$ d. (3) $1\frac{8}{127}$; $1\frac{1}{6}$.
 (4) 538·8; ·5388; 2·2503. (5) 3.
 (6) $\frac{6}{12}$, $\frac{1}{12}$, $\frac{27}{222}$; ·5276; ·123657. (7) 4·1231; 1·3037; 3·5615.
 (9) The latter. (10) £275. (11) £650. (12) £48000.

EXERCISE CCCXXXVII.

- (1) 465718370957. (2) 3; 3; 7; 11; 17; 13; 238901.
 (3) £348 3s. $10\frac{1}{2}$ d. (4) 52560; ·816. (5) 3·1104.
 (6) 1; 4s. $3\frac{7}{8}$ d. (7) £317 2s. 10d.; £182 17s. 2d.
 (8) £215 10s. $1\frac{1}{2}$ d. (9) £1305 18s. $2\frac{1}{11}$ d. (10) £183 15s.
 (11) 72 miles. (12) 60871.

EXERCISE CCCXXXVIII.

- (1) 761710280115. (2) 7; 11; 13; 19; 13; 3220525308.
 (3) £1921 11s. $10\frac{1}{4}$ d. (4) 21900; ·816. (5) 16·83.
 (6) $2\frac{3}{8}$; 11s. $4\frac{1}{4}$ d. (7) £596 10s. 10d.; £403 9s. 2d.
 (8) £212·2232. (9) £396 16s. $4\frac{1}{11}$ d. (10) £367 10s.
 (11) 72 miles. (12) 60877.

EXERCISE CCCXXXIX.

- (1) 44. (2) 421. (3) 1 quart.
 (4) £92 16s. 4½d. (5) £800; £500; £300. (6) 21·2; ·01.
 (7) £31 10s. (8) 20 days. (9) £150; £105.
 (10) Horse 10 minutes, engine 9 minutes: engine wins by 1 minute.

EXERCISE CCCXL.

- (1) 7½; ⅔; ⅓. (2) 13·53; 11·07; 2·0825; ·0675.
 (3) 1. (4) 1·44; ·144; ·00144; ·15; 15; 1·5; 150.
 (5) Gain £56 5s. (6) £10; ½; ⅓; ⅔; ·1; ·2; ·3; ·6.
 (7) £5 16s. 8d. (8) 6 hrs. 24 min. (9) £89 5s. 8½d.
 (10) 5 dwts. 3⅔ grs.

EXERCISE CCCXLI.

- (1) 11. (2) 0. (3) £13 1s. 4d.
 (4) Gains £2 10s. (5) Gain £4 4s. (6) 44·44.
 (7) 2560. (8) 9 men. (9) £6 0s. 6d.; 10s. 4d.
 (10) £240. (11) £35. (12) 25.
 (13) £19 4s. 7½d. (14) 13 yds. 1 ft.

EXERCISE CCCXLII.

- (1) £300; 600; £2400. (2) 3000 men. (3) 12½; ⅔.
 (4) 5 hrs. 44 min. 21½ sec.; £13 8s. 1½d. (5) 7½.
 (6) ·0914; 1200. (7) ·075; 7½d. (8) 1½; 17·2.
 (9) 57209; 5·423. (10) 147. (11) £600.
 (12) £438 10s. 9½d. (13) 876 sq. ft. 18 sq. in.; £29 4s. 1d.
 (14) 15 days. (15) £341 14s. 1½d.
 (16) 2 miles an hour.

EXERCISE CCCXLIII.

- (1) 900 or 810. (2) 8 hours. (3) ·000006; 2500.
 (4) 10½; 30 oz. (5) £102 13s. 4d.; 2½.
 (6) 2603; 1·0003. (7) 3 days. (8) Loses £500 per an.
 (9) 401 sq. ft. (10) 2030; 1824.

EXERCISE CCCXLIV.

- (1) 572733. (2) 3. (3) .0098; 64.
 (4) .5947916̄. (5) £97 13s. (6) .3.
 (7) 69 half-sovereigns, 115 half-crowns, 161 sixpences.
 (8) £320. (9) $3\frac{1}{4}$ per cent. (10) 35 per cent.
 (11) £2566 13s. 4d.
 (12) A wins by $57\frac{1}{4}$ sec., or in distance by $251\frac{1}{4}$ yds.

EXERCISE CCCXLV.

- (1) £5313 8s. $0\frac{1}{4}$ d. (2) $\frac{1}{8}$. (3) 37.5025; 15640.625.
 (4) .874976. (5) $30\frac{3}{8}$ inches.
 (6) 169 yards by 25 yards. (7) 686 francs, 87.5 centimes.
 (8) £1028 8s. 9d. (9) 6 years 3 months. (10) $33\frac{1}{3}$ per cent.
 (11) 117. (12) A in $12\frac{1}{2}$ days; B in $18\frac{1}{4}$ days.

EXERCISE CCCXLVI.

- (1) £2547 3s. 5d. (2) 7. (3) 3.765; 89.375.
 (4) .18916̄. (5) 11856. (6) 115 yards.
 (7) 709 lire, 61.25 centesimi. (8) 6 years 8 months.
 (9) $3\frac{1}{2}$ per cent. (10) £7 8s. 9d. (11) £37 7s.
 (12) $5\frac{1}{4}$ days.

EXERCISE CCCXLVII.

- (1) 772733. (2) $\frac{1}{2\frac{1}{2}}$. (3) 79.99935; 25.
 (4) .352083̄. (5) £3 10s. (6) .3.
 (7) 48 half-sovereigns, 96 half-crowns, 176 threepences.
 (8) $5\frac{1}{2}$ per cent. (9) £141 3s. 7d. (10) 1s. 9d. per lb.
 (11) £18. (12) $13\frac{1}{2}$ ft.; 12 ft.

THE END.

